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A MONTHLY REVIEW OF SURGICAL SCIENCE AND PRACTICE

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ORIGINAL MEMOIRS.

END-TO-END ARTERIOVENOUS ANGEIORRHAPHY*

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ABOUT a year ago, on learning of the work of Carrel and Guthrie of Chicago, with their remarkable and interesting experiments in angeio-anastomosis, the idea occurred to me that in a case of impending gangrene of an extremity, due to interference with the arterial blood-supply, an arrest of the necrotic process might be possible by diverting the arterial current into the veins. The conditions in which I judged that an experiment of this kind would be justified were the following: (1) Threatened gangrene due to embolism; (2) Threatened gangrene due to thrombosed aneurism; (3) Threatened gangrene due to traumatism, with great destruction of arterial tissue; (4) Malignant neoplasm involving important arteries (so that extirpation would threaten the vitality of the part; (5) Angeiosclerotic gangrene.

In Mt. Sinai Hospital the cases of gangrene due to angeiosclerosis far outnumber those due to all the other causes combined; so it seemed to me that my first case

*Read before the New York Surgical Society, November 14, 1906.

would probably be drawn from this class. To be sure, it is well known that in this disease the walls of the veins as well as those of the arteries are thickened, narrowing or even closing the vascular lumen, but the changes in the venous trunks and their tributaries occur later and are apt to be less marked than those in the arteries. Having once averted the gangrene, it was my hope that by general treatment a return of the trouble might be long deferred, or possibly, even prevented.

I began looking about for a case suitable for a pioneer operation, always bearing in mind the maxim "non nocere." My prospective patient must have the disease in such a form that manifestly nothing short of a major amputation would save his life and yet the gangrene must not have progressed so far that a re-establishment of the circulation might not save the remainder of the limb. Several patients with angeiosclerotic gangrene presented themselves at the hospital, but before consent could be obtained amputation became necessary. Then, in April, 1906, a young man was admitted who appeared to be a promising subject. During the time of the preliminary treatment, before angeio-anastomosis had been decided upon, I was fortunate enough to meet Dr. Carrel, who called upon me at the hospital, and I then had the privilege of hearing an accurate description of the operative technique from his lips. This proved to be of inestimable value.

The patient, W. W., entered one of my wards on April 26, 1906. He was twenty years of age, a native of Russia, and a salesman by occupation. With the exception of a chronic gonorrhœa of six years' duration, his history was unimportant up to the time of his vascular trouble, the symptoms of which began several months before I saw him. There was pain and burning in the calves of the legs, gradually increasing in severity until walking became impossible. Two months before admission a painful ulcer developed on the dorsum of the left great toe, the pain extending to the other toes and finally to the entire leg and thigh up to the groin. Another ulcer now appeared on the heel, with dusky red patches on the front of the ankle.

The physical examination was negative as to eyes, ears, nose, mouth, pharynx, glands, lungs, heart, radial pulses, liver, spleen, abdomen and rectum. Slight mucous chronic urethral discharge. General condition was good in spite of a rather marked anæmia. On the inner side of the terminal phalanx of the left great toe there was an ulcer larger than a thumbnail, its outline sharply defined, its edges raised and in part undermined, its floor covered by sloughy granulations discharging thin serous fluid. At the apex of the left heel was a similar ulcer, slightly larger than the one on the toe, its base gangrenous and black. Dusky patches on the point of breaking down were seen on the dorsum of the foot near the ankle. These ulcers and their neighborhood were intensely painful and extremely tender to the slightest touch. The left dorsalis pedis artery could not be felt nor could the left popliteal. Pulsation at the femoral was very faint. The right dorsalis pedis and femoral pulsated normally. The diagnosis of arteriosclerotic gangrene was made and treatment begun with the administration by mouth of glonoin, iodide of potassium, and with mercury by inunction, in the hope that there might be an underlying syphilitic element, even in the absence of its history. On May 16 Dr. B. Sachs saw the patient and concurred in the diagnosis,

In spite of treatment the disease continued to progress, the ulcers became larger, the foot dusky and the threatening area on the dorsum exulcerated. A few inflammatory glands could be felt in the left groin. The general condition of the patient greatly deteriorated and he and his family at length realizing that probably nothing short of amputation could be of avail, consented to a preliminary operation on the blood-vessels as a forlorn hope. It was my intention to anastomose the upper end of the severed popliteal artery with the lower end of the severed popliteal vein, closing by ligation the proximal end of the vein and, if necessary, the distal end of the artery.

On June 2, under gas and ether, I made an incision only to find that the popliteal artery was absolutely obliterated and also its continuation upward as far as could be ascertained through a seven-inch incision. The operation was abandoned and the wound closed by suture.

Four days later, June 6, the operation was performed upon the vessels in Scarpa's triangle. Carrel advises the employment

of extremely fine milliner's needles and silk. In his experiments upon animals he uses needles as fine as No. 16, the eye of which is almost microscopic in size. The mere threading of these needles is no easy task. The finest needle I was able to procure was No 12, and with this I used white ooo silk. The needles were sterilized by boiling in the usual way, the silk by heating it in the sterilizer with vaseline. This silk is put into the vaseline *dry*, so that when the proper degree of heat is reached the entire texture of the thread becomes impregnated with the fat. The needles were threaded and ready before the operation began. In this work a needle holder cannot well be used, and a thimble is necessary in operating upon the thick walls of the larger vessels. A supply of thin tape or "bobbin" was sterilized and ready to be used as temporary ligatures which were not to be tied but held in position by small artery forceps or a spring clamp (*serre fine*). No Esmarch's bandage or other general constrictor should be used. Every necessary adjunct to the most perfect asepsis was employed, but no chemical antiseptics were permitted about the wound.

A four-inch incision crossing Poupart's ligament and running approximately in the line of the femoral vessels exposed these structures to view. A few femoral and inguinal lymph nodes, somewhat enlarged because of the infection in the foot, had to be removed. The exposure of the parts was easy and was very perfect. It was then observed that pulsation of the femoral artery existed only in the uppermost portion of that vessel, so that the anastomosis would have to be made with the upper portion of the vein, above the saphenous tributary. The return flow of the circulation in any event could hardly be through the obliterated arteries, which had remained closed even against the systolic pressure of the left ventricle, but it was hoped that blood for tissue nutrition would be carried through the venous capillaries and that it would find its way back through the gluteal, obturator and other veins, as I had observed in cases of thrombosis of the femoral or even of the external iliac vein.

The vessels were laid completely bare for about two inches and femoral pulsation was controlled by a tape ligature clamped around the external iliac artery. A loosely knotted piece of catgut was also placed around this artery to be used in case of the accidental slipping of the tape. The vein was now perma-

nently ligated at the same level as the temporary arterial ligature, and was temporarily ligated below. My object was to allow for the contraction of the severed vessels, so as to avoid tension at the proposed anastomosis. The artery was then severed about a centimeter below the point of intended anastomosis, and the vein about the same distance above it. After section it was found that this precaution had been a wise one, the mouths of the vessels being easily brought together. There was no hemorrhage. Each vessel had been cut across so as to form a stump of about 2 cm. in length, and the lumen of each of these stumps, especially that of the vein, was carefully emptied of residual blood by gentle manipulation of the vessel walls, and was then filled with sterile vaseline as advised by Carrel.

The vascular suture was performed as follows: A stitch was passed and tied, fastening the two mouths together. At a distance of one-third of the circumference from this first suture, another "anchor" suture was passed, and then a third, so that the sutures marked the angles of an equilateral triangle within the circle of the vascular lumen. The ends of the sutures were left long to permit their being used as retractors. Each stitch was passed directly through all the coats of the vessels in such a manner as to avoid the *turning in* of the walls, but rather to evert them ever so slightly to insure the contact of the intimas. By traction upon the anchor sutures, two at a time, the contiguous parts of the vascular walls were rendered straight and parallel. A running suture was passed along each side of the triangle and was tied to the anchor suture as soon as the angles were reached, so as not to break the continuity of the junction. By careful handling of the anchor sutures the vessels (vein and artery) were rotated around the longitudinal axis, bringing within easy reach that side of the triangle which was being sutured. The previous thorough dissection rendered this very easy. Just before the last running suture was tied to its anchor the vessels were emptied of vaseline by gentle manipulation. The final knot being tied, the tape compressing the femoral artery was removed, and at once the pulsating current was established from artery to vein without the suspicion of leakage. Pulsation was marked in the visible part of the femoral vein and could be felt, though intermittently and with some difficulty in the external saphenous. Carrel states that in the larger vessels of

dogs it takes about 20 minutes for the arterial blood to force the venous valves. In this case no pulsation of any of the veins of the foot was noted, but from the ulcers, which at the beginning of the operation were markedly cyanotic and did not bleed, bright red blood began to exude.

Within ten minutes the foot appeared to have recovered somewhat from the intense cyanosis incident to the ligation of the femoral artery, but it never even approached the normal in color. The wound was sutured and dressed dry, the entire limb splinted and slightly flexed at the hip, and carefully covered with a thick elastic layer of non-absorbent cotton. The entire operation consumed about 50 minutes. The patient's condition at its termination was one of shock, though practically no blood had been lost. Pulse 150°, weak and irregular. This shock continued and deepened. By the next morning the pulse was hardly perceptible. Very little urine had been passed —albuminous, with hyalogranular casts—and altogether the patient's condition was such as to forbid anything excepting general stimulation, which was most energetically carried out.

Eighteen hours after the completion of the operation a distinct line of demarcation had formed, crossing the upper portion of the dorsum of the foot, thence up the sides of the leg and crossing the calf about seven or eight inches above the point of the heel. This entire area was now obviously without circulation: cold, numb and gangrenous. Above this line, however, there was fair circulation and the patient easily located a pin-prick. Pulsation could not be felt in the saphenous vein.

The profound shock was not easy of explanation. To be sure, there had been a severe disturbance of his circulatory apparatus, but this would also have been the case had I amputated. Indeed, I had intended to amputate in the event of the failure of the angeiorrhaphy, but this plan had to be abandoned because of the shock. Death occurred 31 hours after the operation, following an ante-mortem rise of temperature to 105°. It is my belief that any radical operation would probably have been followed by a fatal result, and that the death should not be ascribed to the angeiorrhaphy.

A post-mortem examination to ascertain the cause of death was most unfortunately refused, so it was possible only to secure the specimen of vein and artery taking in the anastomosis.

This showed a smooth union with an extremely soft clot in the vein—possibly formed just before death, when the circulation was at its lowest ebb. There was not the slightest hæmorrhage, bulging of the vascular walls or other indication of a giving way under the arterial pressure.

In spite of the failure of this operation we may study its various phases with profit.

In the first place, we must recollect that the condition for which it was undertaken is absolutely hopeless so far as saving the limb is concerned. Amputation either well below the knee or at midthigh is the usual form of successful treatment, the osteoplastic operation having yielded in my experience the best results. Yet, sloughing of the flaps with re-amputation is common enough and the post-operative mortality due to the general vascular disease is high.

In the experiments of Carrel, the subjects being healthy animals, a complete reversal of the circulation of the extremity was possible, but in cases of arteriosclerotic gangrene the most that could be hoped for would be the carrying of arterial blood for tissue nourishment through the less diseased vessels, the veins, and back again through other veins—return flow through the diseased and obliterated arteries being obviously out of the question. Actual experiment alone could demonstrate the practicability of this operation, and since in the above case the anastomosis had to be made so high in the main vascular trunks, the matter has not been decided. Had it been possible to work with the popliteal vessels, as originally planned, more light would have been thrown upon this important point.

In threatened gangrene due to embolism of arteries distal to a main trunk, the promise of success seems to me good. For example, in embolism of the popliteal artery, end-to-end anastomosis of superficial femoral artery with the saphenous vein might re-establish a circulation in the affected part, averting the necrosis. Practically nothing would be lost in the event of failure. This procedure might also

be tried in cases of thrombosed aneurism of the popliteal artery.

In destruction of a portion of the main artery by traumatism or because of the implication of its walls in an otherwise operable malignant growth, a resection of the artery with interposition of a piece of vein might be practised.

The work in angeiosclerotic gangrene should be continued, but more and more favorable cases should be selected for experiment.

One point demonstrated by this operation is that the danger of immediate traumatic aneurism following the implantation of artery into vein in the human subject, has been overestimated.

NOTE.—The case here reported is probably the first in which artery has been anastomosed with vein without a corresponding counteranastomosis of vein into artery. After my paper had been presented I learned of the case of Dr. Joshua C. Hubbard, of Boston, who had operated for gangrene about one month before my operation, and who had attempted to accomplish complete reversal of the circulation according to Carrel's suggestion, but without employing his methods. Dr. Hubbard was fortunate enough to secure an operative recovery, though without curing the gangrene. The limb had to be amputated. His case was published in the ANNALS OF SURGERY for October, 1906.

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ROTARY DISLOCATIONS OF THE ATLAS.

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In this paper there will be brought to notice a dislocation which with the modern improvements of skiagraphy will be found to be of infinitely more frequent occurrence than it has been in the past. Moreover, being by no means necessarily fatal, it was previously overlooked; so that now more and more recoveries will be recognized. There is a minor degree of this dislocation, a subluxation (which will form the matter of another paper*) which will be found to be still more frequent than the complete displacement.

As anatomists have paid very little attention to the atlanto-axial joints, excluding that between the odontoid process and the atlas, it is desirable that a few words be said about them. For practical purposes the joint surfaces may be described as plane and the atlas be said to glide upon the axis. The articular surfaces are not horizontal but are directed downwards and outwards on either side. They are also directed slightly forwards. Thus the atlas rests upon two oppositely inclined planes of the axis. In order to allow for the gliding movements of these joints the ligaments are lax and loose.† In consequence, our heads have to be held firm by muscular effort and not by any other means. If this tonic muscular action is abolished the ligaments allow the head to rotate 30 degrees either side of the middle line. Any violence acting at such a time has what may be termed a "flying start" before it meets any resistance. These joints are peculiar in the whole spine for their adaptation to give a large extent of rotatory

*Transactions, Clinical Society of London, 1906.

† American Journal of Medical Sciences, 1907.

movement; with the result that when any violence is applied obliquely to the head or the spine, these horizontal atlanto-axial joints will suffer the most severely. In spite of this special liability to injury, no surgical study has been made of these joints. In this communication an attempt has been made to remedy this defect and to direct attention to a dislocation which is a great deal more frequent than is thought and is by no means necessarily fatal, so that it

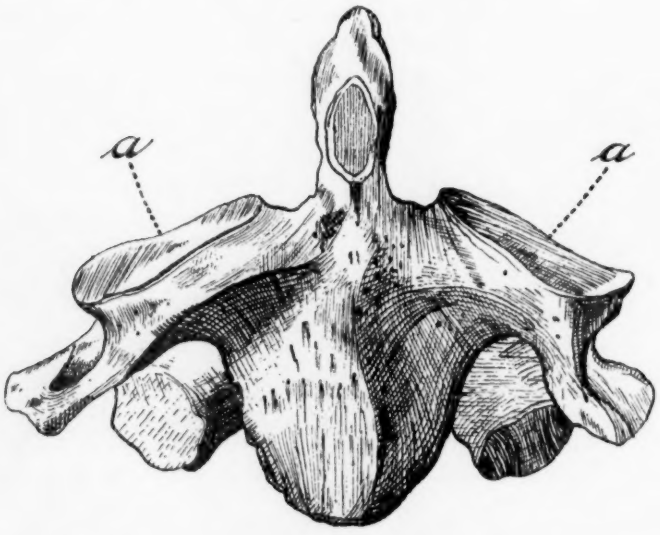

FIG. 1.—Front view of the axis vertebra, to show the outward, downward and forward inclinations of the superior articular facets (*a*, *a*).

is far more commonly overlooked than discovered. The author reports two new cases.

Twenty examples of rotatory dislocation of the atlas have been collected. Two belong to the author, and have not been fully reported as yet, the other eighteen have been gathered from the literature. No museum in the British Isles has a specimen, except that of St. Thomas' Hospital Medical School, London.*

*The same museum is unique in possessing an example of unilateral rotatory dislocation of the axis on the third cervical vertebra. Specimen 192.

It has been decided to report these in two classes—cases in which the injury was confirmed post mortem, and cases which recovered. The author's cases are reported in their proper classes.

Examples of the first class are subdivided into those with the rotatory dislocation alone and those in which the dislocation was complicated by a fracture. There is only

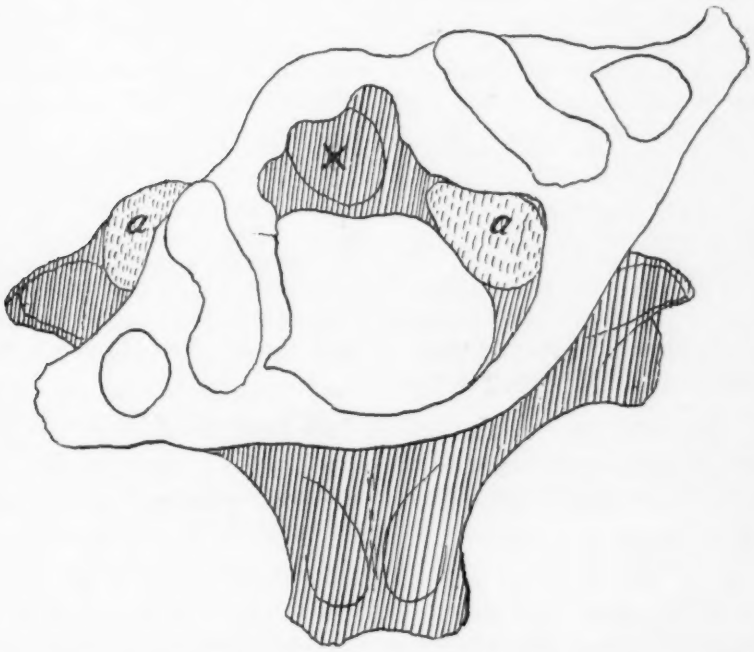

FIG. 2.—Showing anterior displacement of the right side of the atlas (unshaded), on the axis (shaded). The dislocation is only represented as incomplete in the diagram. X indicates the odontoid process and *a*, *a* the superior articular facets of the axis.

one possible case in the first category, rotatory dislocations being almost always complicated by other injuries. This would suggest that cases of uncomplicated unilateral dislocation recover. In this case, Buisson's, it is not quite clear if there really was a dislocation between the atlas and the axis, as well as between the atlas and the occiput. Buisson's case can be doubtfully included in this paper. In this dislocation the vertebral artery of the dislocated

side must run a great risk of being torn. Dupont alone has recorded its rupture.

There is only one possible example of a fatal case of rotatory dislocation of the atlas without other injury, which was recorded by Buisson in 1852. The description is not perfect and it is not clear if the atlas was dislocated from the axis, though such is inferred.

I. Rotatory Dislocation of the Atlas. Buisson. (*Bulletin de l'Academie de Medicine de Paris*, 1852–53, xviii, 102).—A youth, aged 16, was reaching under a cart which was supported by a stake; disturbing the prop, the cart fell on him. Besides the injury to the neck there was a fracture of the right leg. Death was immediate.

Post mortem.—The muscles of the neck were badly bruised, particularly on the right side. The atlas, especially on the right lateral mass, was carried forward, its articular facet being in front of the condyle, which had slipped back; its articular surface was entirely separated from that of the atlas. The ligaments of the condyle which kept it in position, with the articular process of the atlas, were torn from left to right. The occipito-odontoid ligament on the right side was torn off the condyle. The displacement narrowed the spinal canal by half the channel of the foramen magnum.

In eight cases the lesion has been confirmed by an autopsy and was found to be complicated by other injuries; in six the odontoid process of the axis was broken, in one the atlas was broken, in another there was a lateral fracture of the axis as well (Corner's case), and in another the fifth, sixth, and seventh cervical vertebræ were broken. In seven cases the lesion was apparently unilateral, and in one bilateral. As the atlanto-axial joints allow considerable movement without any dislocation, it is often very difficult to decide whether the dislocation is bilateral or unilateral. This difficulty is accentuated by the fact that in some of the unilateral dislocations there is a partial dislocation of the joint of the other side.

Of these fatal cases, in only two did death follow soon after the accident; one in a "few hours" and the other in twenty hours. In the other six, death resulted after periods ranging from twenty-three days to many years,—a very significant fact, as it shows that these injuries need not be

fatal and, when in the living, they are easily overlooked. Gibson's case died on the twenty-third day, Cortes' in the eleventh week, Bernstein's on the one hundred and first day, Lambotte's after fourteen months, whilst Broca's and Corner's were found accidentally after death, many years after the injury.

The absence and onset of paralytic symptoms is also very noteworthy. Neglecting the two rapidly fatal cases, David's and Dupont's, none of the cases presented any paralysis, etc.,—*i.e.* spinal cord symptoms—at first. In Broca's and Corner's cases they never occurred at all. Gibson's case died suddenly on the twenty-third day from a sudden increase of the dislocation, due to injudicious movements, without ever having had any paralytic symptoms. Cortes' case developed spinal symptoms only at the beginning of the tenth week after the accident; Bernstein's on the seventy-first day; Lambotte's after a year.

The absence of spinal symptoms in so many cases points to the ease with which the injury may be overlooked. The sudden death of Gibson's case shows the penalty that may be paid for overlooking it, whilst Cortes', Bernstein's and Lambotte's cases show that a guarded prognosis should be given for some time after the accident, because of the onset of myelitis.

II. Bilateral Rotatory Dislocation of the Atlas, with Fracture of the Odontoid Process.—Broca, in the *Bulletin de la Société de Chirurgie* (1863, 3rd series, 549), reports that on autopsy in an old man who died of an urinary disorder, the occipital foramen was found nearly obliterated. The specimen showed a dislocation of the atlas on the axis, with fracture of the odontoid process. It was a lateral displacement with a certain degree of rotation. During life the man had carried his head a little obliquely and the neck stiffly.

III. Unilateral Rotatory Dislocation of the Atlas, with Fracture of the Odontoid Process. Bernstein. (*Deutsche Zeitschrift fur Chirurgie*, lxx, 174; *Centralblatt fur Chirurgie*, No. 4, iii).—A man, 18 years of age, fell from a step of a carriage, receiving a blow on the left side of his neck. His head had a twist of 40 degrees to the left. Up to the seventy-first day of his illness he had no spinal symptoms. Paralysis then began in the right arm, involving successively the right leg, left arm, left leg, bladder, rectum, and diaphragm. Death on the 101st day after the accident.

Post mortem.—Fracture of the base of the odontoid process with callus formation which led to the compression of the cord. Forward rotatory displacement of the atlas, the right side being displaced forwards on the axis. The left side was in its proper place.

IV. Unilateral Rotatory Dislocation of the Atlas, with Fracture of the Atlas and Axis. Corner. (*St. Thomas' Hospital Museum Catalogue*, 187).—Unfortunately this remarkable case has no clinical history; but, fortunately, the subject of the injury lived and was not paralyzed, as is evidenced by the signs of sound repair about the fracture. As a result, the bones bear marks which have been engraved upon them by the movements of the neck subsequent to the healing of the fracture. These tell their tale, allowing us to ascertain some of the results of the injury. The specimen consists of part of the occipital bone and the atlas, the axis being wanting. Luckily the atlas bears upon it unmistakeable signs of the condition of the axis.

The occipital bone is ankylosed on both sides to the atlas. It is impossible to say whether there has or has not been any fracture of the occipital condyles.

The atlas is much misshapen in consequence of fractures, which have been completely repaired by bone, ankylosis to the occiput accompanying that repair. A fracture has taken place at the apex of the posterior arch and has been united by fibrous tissue, not by bone. In the region of the right lateral mass there has been a further injury. This fracture has apparently been comminuted, accounting for the great deformity of the lateral mass. The damage to the atlas has been confined to the right side, a point which indicates that the head at the moment of the accident was on the right side, so that all the violence was transmitted to the right condyle. The ankylosis of the corresponding occipito-atlantal joint was a direct consequence of the injury; the ankylosis of the joint of the opposite side was secondary and a result of that on the right.

The fractures of the atlas are two in number. The primary one was in all probability the comminuted one of the right lateral mass, owing to the right occipital condyle being impacted on to it. On account of the mechanical disposition of the articular surfaces, the same impact would drive the lateral mass outward and lead to a secondary snapping of the posterior arch, as in the breaking of a bird's "merrythought."

The condition and disposition of the axis can only be inferred by the articular facets on the under surface of the atlas. The left articular facet is markedly smaller than is normal and has been covered with cartilage in the recent state. The facet for the odontoid process presents many peculiarities. Instead of being more or less circular, it is much elongated from above downwards, the process articulating with the left side of the foramen magnum. Its vertical or long axis is oblique and quite out of harmony with the left atlanto-axial facet just described. Therefore, between these two facets there must have been a fracture. Under the large deformed right lateral mass of the atlas, continuous with the facet for the odontoid process just mentioned, is a new facet which must have been a joint between the atlas and the body of the axis. To the right of this

FIG. 3.—Photograph of specimen of Case IV.

impression there is the place where the right articular facet for the axis should be. This can be traced in outline, but the surface has evidently *not* been covered with cartilage. There must have been a dislocation here as there has been ankylosis of the atlanto-axoid joints. To sum up, the articular surfaces on the under part of the atlas indicate that there had been a lateral fracture of the left side of the axis, involving the outer part of the superior articular facet, and a rotatory dislocation of the rest of this joint and also of that of the other side. That is to say, there has been a lateral fracture with rotatory dislocation of the axis without causing death.

The dislocation of the axis has resulted in the displacement of the right fragment of the atlas backwards and slightly inwards; and the left

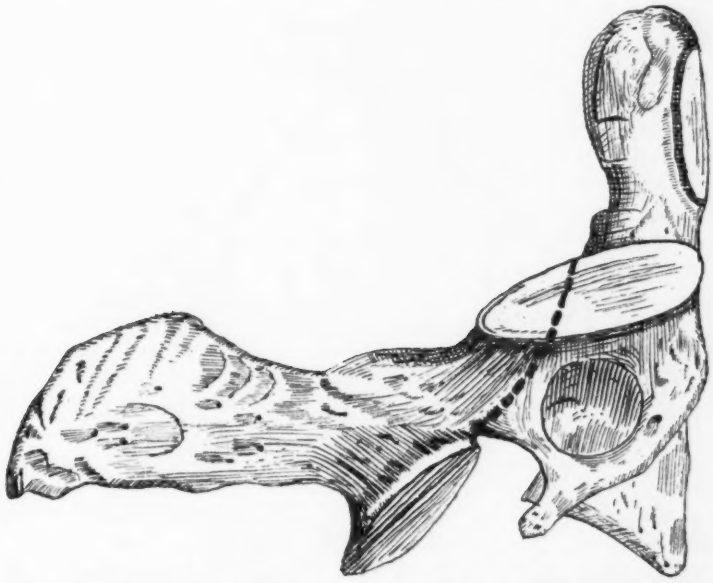

FIG. 4.—Side view of an axis vertebra. The dotted line indicates the site of a *lateral fracture*. See American Journal of Medical Sciences, 1907.

fragment forwards and outwards. There is also some rotation of the vertebræ on their transverse axis.

A few words must be said as to the possibility of a fracture of the base of the odontoid process having occurred.* This seems not an unlikely thing when the presence of the unilateral dislocation of the atlas is taken into account. But there are several reasons to make us think otherwise. In the first place the process has worn for itself a well marked facet, which a broken off process would be hardly expected to do. Such might occur if the fragments united with bone. But fibrous union alone is

*Transactions of the Medical and Chirurgical Society, London, 1907.

known to occur in 97 per cent. when this fracture is required. Also, the articular facet for the odontoid process is continuous with the new facet for the body of the axis, as has been pointed out above, which suggests continuity of bony structure, and therefore no fracture. Apparently, the process has preserved its proper anatomical relationship with the body of the axis, as is shown by the facets. Moreover, the integrity of the process would have a great deal to do with the prevention of instantaneous death, for by locking between the anterior arch of the atlas and the transverse ligament, it will limit the displacement of the axis and prevent damage to the spinal cord and its membranes. In this we may compare Lowson's case*

A similar question of fracture of the odontoid process was raised

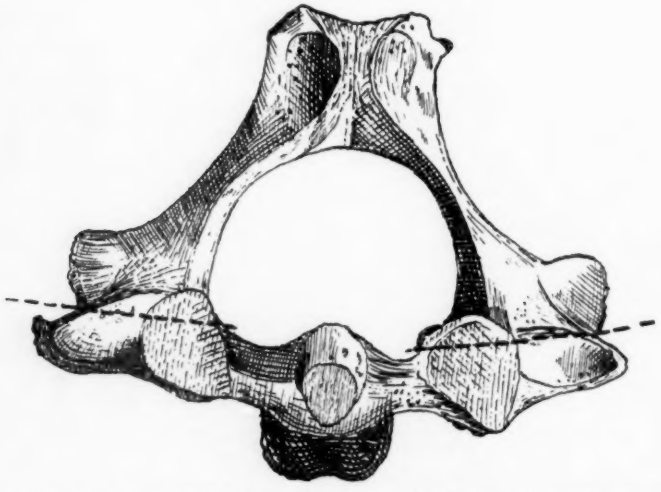

FIG. 5.—View of the atlas vertebra from above. The dotted lines indicate the situations of lateral fractures.

about the author's other case (XIII) and, likewise, it was decided not to be present.

V. UNILATERAL ROTATORY DISLOCATION OF THE ATLAS, WITH FRACTURE OF THE ODONTOID PROCESS. CORTES. (Malgaigne's "Fractures," 11, 329).—A youth, aged 15, was thrown to the ground and received several blows on his head and neck. He was quite well for nine weeks; then he lost the use of his limbs, and died in the eleventh week.

Post mortem.—It was found that the atlas was dislocated forwards with the right side more advanced than the left. The odontoid process was fractured across its base and lay almost horizontal.

VI. UNILATERAL ROTATORY DISLOCATION OF THE ATLAS, WITH FRACTURE OF THE 5TH, 6TH, AND 7TH CERVICAL VERTEBRÆ. DAVID. (*Bulletin de la Société Anatomique de Paris*, 1888, lxiii, 910).—A man, aged 26,

* Medico-Chirurgical Transactions, 1875.

was caught by a buffer in the upper part of the neck and thrown some distance. When seen the neck was very painful. There was a suboccipital depression extending as far down as the spinous process of the axis; a corresponding projection could be felt in the pharynx. There was paralysis of all four limbs. Death 20 hours after the accident.

Post mortem.—There was dislocation forwards of the atlas upon the axis, to the left side, with compression of the cord. There was also a vertical fracture of the posterior and middle parts of the body of the fifth cervical vertebra. The sixth and the seventh vertebræ were likewise fractured.

VII. Unilateral Rotatory Dislocation of the Atlas, with Fracture of the Odontoid Process. Dupont. (*Bulletin de la Société Médicale de la Suisse*, 1876, x, 65).—A man in delirium tremens leapt from the fourth story of a building. Death resulted in a few hours. Upon post-mortem examination there was considerable separation between the atlas and the axis. The latter was luxated backwards and pivoted on its left atlanto-axial joint, which remained in its proper place. The odontoid process was fractured at its base, but owing to the fact that the ligaments remained intact there was no displacement of the process. The vertebral artery was also ruptured.

VIII. Unilateral Rotatory Dislocation of the Atlas, with Fracture of the Odontoid Process. Gibson. (*Lancet*, 1885. ii. 429).—A man, aged 58, rolled down a bank and lay there all night. Upon rising, he was too unsteady to walk and had to be assisted home. His head was very much set forward, the chin resting on the sternum. It was held rigidly in this position. He said that he was suffering from a pain of a burning character. There was a great prominence at the back of the neck just below the occiput. The highest cervical spine was two inches from the occiput. A diagnosis was made of a displacement between the atlas and axis. There was no paralysis. He was laid on the bed and steady traction applied to the head, when the dislocation suddenly reduced with a snap. Crepitus was also felt, indicating the presence of a fracture. The prominence of the spines disappeared and the head went naturally into line with the body. A week later he was seized with abdominal pain after eating some bread and butter. Whereupon, in spite of efforts to prevent him, he started up and almost immediately fell back dead.

Post mortem.—Considerable separation was found between the atlas and axis. The cord was tightly stretched and pulled against the anterior wall of the canal. There was no damage to the cord. The odontoid process and part of the body of the axis was broken off and remained in its situation against the arch of the atlas, the transverse and other ligaments being intact.

Death after twenty-three days.

IX. Unilateral Dislocation of the Atlas, with Fracture of the Odontoid Process. Lambotte. (*Annales et Bulletin de la Société de Medicine d'Anvers*, 189, lvi, 031–133).—The fracture was produced by a simple movement of extension of the head, while the young woman

was sewing. Afterwards, she suffered from pains in the head and a stiff neck. A year later she began to suffer from paralysis in the upper limbs, imperfect anæsthesia, exaggerated reflexes, etc. Death occurred about fourteen months after the injury.

Post mortem.—The odontoid process was found to be fractured across its base transversely, and repaired by some fibrous tissue. The atlas was dislocated forwards on the right side only. The transverse and check ligaments were intact.

Having gleaned what knowledge was possible from the records of fatal cases of rotatory dislocation of the atlas, it now remains to apply that knowledge to reported cases of recovery from that injury. Ten of these have been collected,—the earliest being Bayard's, in 1870, and the latest the author's, in 1905. Of these ten, only one presented any spinal symptoms—the second case of Lannelongue; but the description is insufficient to enable it to be said to what extent. In only one is the odontoid process known to have been broken—Bayard's case—which is striking when compared with the fact that that fracture was found in six out of eight cases in which there was a post-mortem examination.*

In Billot and Picque's case, as in the author's, the patient had considerable difficulty in swallowing. In my case the patient had great difficulty in opening his jaw as well.

In the instance recorded by Uhde, Hagemann and Boettger, the right hypoglossal nerve was permanently paralyzed. It is hardly conceivable that this nerve could have been stretched or ruptured by the dislocated atlas. The probable key to the explanation is to be found in a case of Sir James Paget's which was shown before the Clinical Society.† The hypoglossal nerve was injured in a case of fracture of the posterior fossa of the base of the skull. The violence which produced the dislocation of the atlas in Uhde, Hagemann and Boettger's case would have been prone to fracture the posterior part of the base of the skull. It would appear that this instance is an example with coin-

*Transactions of the Medico-Chirurgical Society, 1907.

†Clinical Society's Transactions, iii, p. 183.

cidence of the injuries. The difficulty in swallowing, noticed by Billot, Picque and the author, was probably due to the dislocation causing some injury to the first or second cervical nerves, so rendering the pharyngeal plexus inefficient. Sir Thomas Barlow has published a case of hemiatrophy of the tongue with paralysis of the soft palate, following injury to the upper cervical spine and (?) to the rim of the foramen magnum, in the Transactions of the Clinical Society of London, 1889, xxii, pp. 322–327. He regards the symptoms to have arisen in consequence of cicatrisation in the healing of the fracture in the occipital bone. The cases of Sir James Paget and Sir Thomas Barlow, in all probability offer the correct explanation of the paralysis of the right hypoglossal nerve observed by Uhde, Hagemann and Boettger in the case which they have recorded (XIX).

X. Unilateral Rotatory Dislocation of the Atlas. Bacon. (*University Medical Magazine*, 1891, iii, 182).—A man, aged 22, fell down sixteen steps, striking his head. He was conscious and able to walk. His head was slightly flexed and turned to the right. It could not be moved.

On examination, the spinous process of the axis was turned to the left and upwards for a quarter of an inch. In the pharynx, corresponding to the body of the axis, was found a marked projection. There was no paralysis or anæsthesia.

The man got quite well and the movements of his head returned to a limited extent.

XI. Fracture of the Odontoid Process and Rotatory Dislocation of the Atlas. Bayard. (*Boston Medical and Surgical Journal*, 1870, N. S., v. xliii).—A girl, aged 6, fell, a month previously, from a pile of boards about five feet high, striking her head and neck. Afterwards she could not move her head without pain. She was treated for neuralgic pains in the neck.

The head was inclined forward and to the right; she supported it with her hand under her chin. Any attempt to rotate or move it caused great pain. No irregularity could be found in the vertebræ of the neck. She was ordered to be kept on her back as much as possible. Nine months later she walked well, but still supported her head. The head now rested on the right shoulder and the neck was much altered in shape, the irregularity giving the impression that there was a "partial luxation of the atlas and axis." She wore an apparatus to support her head for a year, at the end of which she could hold her head up and even rotate it consider-

ably. Three years after the accident she had an abscess in the neck from which was discharged the separated odontoid process.

XII. Unilateral Rotatory Dislocation of the Atlas. Billot and Picque. (*Bull. et Mem. de la Soc. de Chir. de Paris*, 1900, xxvi, 23).—A man, aged 21, fell upon his head a distance of three and one-half metres, without losing consciousness, got up and walked a hundred metres. He complained of violent pain at the nape of his neck, great difficulty in swallowing and on movement of his head. There was no paralysis or anæsthesia. The pain in the neck disappeared in about fifteen days; the dysphagia lasting a little longer. At the end of three weeks he was sent back to his regiment with only a stiff neck. The face was turned a little to the right. The upper part of the neck was deformed; a little out of the median line a prominence was visible. The spinous process of the axis was deviated a fingerbreadth to the right. The movements of flexion and extension were very limited and rotation was very incomplete. There was a protuberance in the right side of the pharynx. The case was called one of dislocation to the right of the atlas by rotation of the vertebra upon its body, without fracture of the odontoid process.

Recovery without any serious effects.

XIII. Unilateral Rotary Dislocation of the Atlas on the Axis, with Fracture of the Anterior Arch of the Atlas. No Paralytic Symptoms. Recovery. (Corner.) (*Clinical Society's Transactions*, London, 1905.) Shown at the Clinical Society of London, February 24, 1905.—J. L., aged 21, fell from off a horse, striking his forehead. Beyond making him "see stars," he was not much hurt. He got up and rode his horse home. He came to St. Thomas' Hospital complaining of a stiff and somewhat painful neck, and was treated with liniment and rubbing; but as he was no better at the end of a fortnight he was admitted.

Examination.—The patient carries his head a little flexed and turned to the right. Movements are limited and the neck is stiff. The left transverse process of the atlas is easily palpable between the mastoid process and the angle of the jaw. On the right side it cannot be felt, the examining finger sinking into a groove. Further palpation gives the impression that the transverse process is displaced backwards. There must be a dislocation of the right atlanto-axial joint. On the right side of the neck, below the point just mentioned, there is felt a prominence of the middle of cervical vertebræ, which shows that there has been some accompanying rotation of the vertebræ below the dislocation. After a few minutes' standing the man became fatigued.

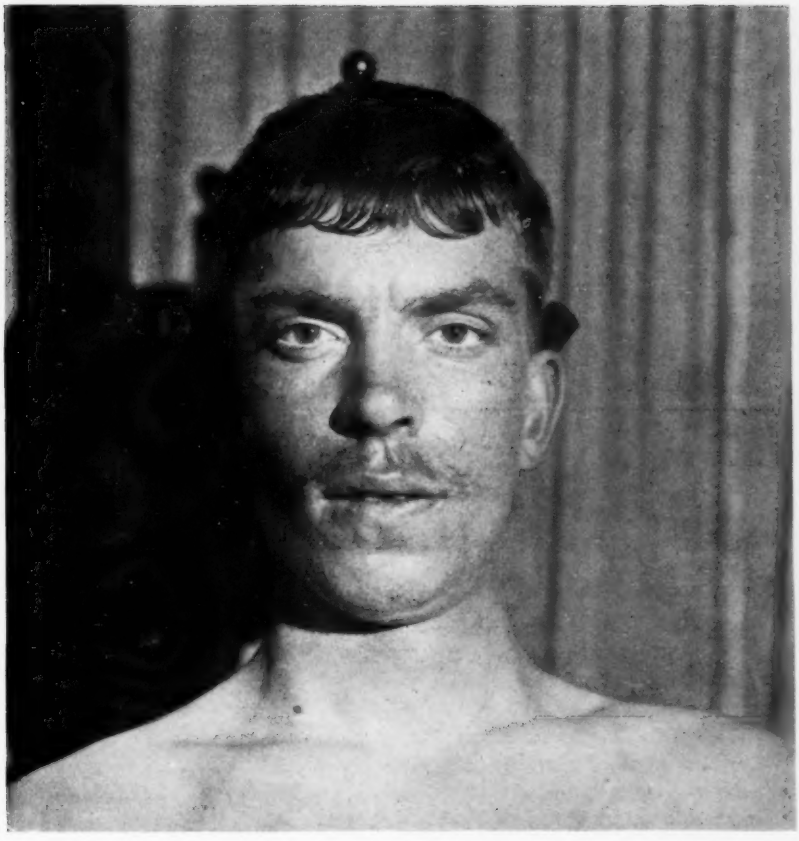

FIG. 6.—Photograph of J. L., showing his chin turned towards his right shoulder.

An examination on a later day confirmed the above observations and it was further remarked that he could rotate his head to the right or injured side, but not to the left or uninjured side. A further observation was that he had difficulty in opening his mouth and his articulation was indistinct. There was no difficulty in swallowing such food as the restricted movements of his jaws allow him to take. He was never able during his stay in hospital to open his mouth sufficiently to allow his pharynx to be examined by a finger. There were never any paralytic or anæsthetic symptoms.

When his pharynx was examined, after his jaws had recovered sufficiently to enable him to open his mouth, the right side of the atlas, which was displaced forward, could be felt as a prominence on the posterior wall.

The skiagraph shows the unilateral dislocation of the atlas from the fracture of the anterior arch of the atlas. It is not clear whether the odontoid process is broken, but it was generally thought at the meeting (Clinical Society*) to be intact.

XIV. Unilateral Rotatory Dislocation of the Atlas. Hesse, (*Beitrage zur klin. Chir.*, 1895, xii[i], 93).—A man fell from a cherry tree. striking on his head. His head was turned to one side and his neck was stiff and immovable. He was never fully unconscious and had a peculiar sensation about his arms and legs. There was no paralysis. The head was replaced when under an anæsthetic. Professor Socin diagnosed a "torsion luxation of the atlas." The recovery presented nothing noteworthy.

Described as an example of the rotation luxation of Uhde, Hagemann and Boettger.

XV. Two Cases of Unilateral Rotatory Dislocation of the Atlas. Lannelongue. (*Compt. Rend. de l'Academie de Science*, Paris, 1904, cxxxix, 495–6.) Case I.—A child, 8 to 9 years of age, hung himself accidentally whilst playing. There was an unilateral dislocation of the atlas on the axis, which was reduced and the child made an uninterrupted recovery.

XVI. Case II.—An officer was thrown from his horse and suffered from a similar dislocation of the atlas on the axis. He had four-limbed paralysis. Reduction was followed by recovery, though it is not stated whether the paralysis passed off completely.

XVII. Unilateral Rotatory Dislocation of the Atlas. Legg. (*Lancet*, 1893, ii, 1382).—A lad (schoolboy) tumbled over another boy in the playground and, turning over, caught the back of his head in an angle formed by the trunk of a tree and the ground.

* Clinical Society's Transactions (London), xxxviii, p. 228; also in the next volume.

The head remained twisted to the left and he was quite incapable of rotation, all attempts at it causing great pain. The chin was somewhat raised so that he could not see his toes. Pressure over the lower cervical spinous processes caused no pain and disclosed no irregularity, but when applied to transverse process of the atlas, especially on the right side, it caused great pain. The diagnosis was "a probable rotatory dislocation or hyper-rotation of the atlas upon the axis." The dislocation was reduced by exerting traction on the head with counter-extension on the trunk, a click being heard at the moment of reposition. Recovery uneventful.

XVIII. Unilateral Rotatory Dislocation of the Atlas. Panas. (*L'Anjou Médical*, 1898, 41).—A case of luxation of the atlas and axis was described with special reference to the symptoms of amblyopia. The man fell whilst carrying things. There was right torticollis. Not much space is given to the dislocation itself. The sight of the right eye was lost some days after the accident. There is a long account of the possible pathology of the ophthalmic symptoms. Recovery from the injury. There never were any paralytic signs.

Mr. J. B. Lawford, Ophthalmic Surgeon to St. Thomas' Hospital, to whom I showed this paper, thought Panas' explanation insufficient. M. Panas is the only observer to mention eye symptoms in these cases.

XIX. Rotatory Dislocation of the Atlas. Uhde, Hagemann and Boettger. (*Archiv fur klinische, Chirurgie*, 1878, xxii, 217).—A man, aged 34, fell thirty feet. He sustained a comminuted fracture of the right humerus. There was also pain and tenderness with immobility of the neck. The head was carried bent over to the right, the chin being directed to the left. Moreover, the head was flexed, thus being twisted on all three axes. On the right side the transverse process of the atlas could not be felt in its proper position and the finger sunk deeply into the neck in this place. It was ascertained that the right transverse process was displaced forwards. The corresponding process on the left side is asserted to be displaced backwards, but it is not made clear upon what authority the statement is made. There was a permanent paralysis of the right hypoglossal nerve. There were no spinal symptoms. The deformity was restored by extension and the man recovered. The case is called one of luxatio atlantis violenta, with dislocation of the atlanto-axial joints.

It now remains to draw in brief form the features by means of which rotatory dislocations of the atlas may be observed clinically, so that the lesion may be recognized as an important and not infrequent injury amongst instances of sprained necks.

To begin with, there is the history of the accident, in which the violence is commonly applied to the front and top of the head. There are no symptoms of paralysis or anæsthesia, neither has there been recorded a case of spinal concussion.* The neck is painful to touch and to move. It is stiff and capable of little movement. The position of the head is very characteristic. It is flexed and turned a little to one side, usually the right. In more severe examples the head is bent towards one shoulder so that the chin points to the other side. In the latter case, it is probable that the head cannot be moved. In the former and less severe varieties, the head can be rotated more to the side to which it is directed than to the other.

The side to which the chin is directed is that on which the transverse process of the atlas is rotated backwards. The side to which the head cannot be rotated is that which is, or is only partially, dislocated. For the joint of the side to which the head is rotated is fixed, forming the centre of the curve along which the other joint moves. For example, in turning the head to the right, the right atlanto-axial joint is fixed and the left moves, and vice versa. If the left side is dislocated, the head can only rotate a little to the right, as the left joint does not exist. It can be rotated a little to the left, since the right joint can move, but only a little, as the forwardly dislocated left joint is the fixed point and will not permit more. By means of the rotatory movements present it is possible to decide whether the injury is unilateral or bilateral, but care must be taken in making observations.

Normally, the transverse process of the atlas can be felt half way between the tip of the mastoid process and the angle of the jaw. This can be felt plainly on the side from which the head is turned, unless, when the patient looks forward, it is hidden by the angle of the jaws. On the side to which the head is bent it cannot always be felt, the finger sinking deeply inward and forward into the neck;

*Lancet, ii, 1906.

the transverse process of the atlas has been displaced backwards. A similar observation must be made frequently on a sound but rotated neck; otherwise it is not easy to make. From the back, the spine of the axis, when it can be seen or felt, is deviated somewhat to the side from which the head is bent. This is not due to the fracture, but to the lateral curvature of the cervical spine, which is caused by the flexion and rotation of the head. The condition of the spine of the axis is of some interest, as sometimes it is more prominent than usual and at other times less prominent. The prominence of this spine is due to flexion and forward displacement of the head. Great prominence means much forward displacement of the head, and therefore the odontoid process is very likely to be broken.

An examination of the pharynx, preferably under chloroform, reveals two prominences, that on one side being due to the forwardly displaced transverse process, and that on the other, which is bulkier and less distinctly defined, being due to the part of the axis which has been denuded by the backward displacement of the transverse process of the atlas on that side. Attention has never been directed to these *two* points to be ascertained on examination of the pharynx.

A skiagraph of the lateral view of the head shows a forward displacement of one side of the atlas, owing to the transverse axis of that bone being oblique to the rays. It confirms the clinical observations. A most important thing is to ascertain if the odontoid process has been broken or not. If it has not, there is far less danger if a reduction of the dislocation is attempted, a proceeding which is dangerous if it is. This is not easy to make out, as the two lateral masses of the atlas when viewed from the side are normally one behind the other; in a rotatory dislocation they are seen laterally *en échelon*, obscuring the odontoid process. It is possible in most cases, especially in the recent one, to decide whether or not there has been a fracture. Later, the outlines of the bones become obscured from some

callus and inflammatory reparative formations. The integrity or otherwise of this process is extremely important to the life of the patient, as if intact it will lock between the anterior arch of the atlas and the transverse ligament. If it is broken there is little to protect the cord from an injury.

Anterior skiagraphs show nothing, and, owing to the rotation of the head and the patient's inability to open the mouth wide, a skiagraph of the odontoid process cannot be obtained.

The five points upon which to rely for a diagnosis are the *position of the head*, the *positions and fixity of the transverse processes of the atlas*, the *examination of the pharynx*, and the *skiagraph of the lateral view of the neck*. There is usually nothing which will absolutely exclude fracture of the odontoid process. If the process is broken, death may easily result from a sudden increase in the amount of the dislocation. If it is unbroken, it will lock with the anterior arch of the atlas and the transverse ligament, being a safeguard to the spinal cord. Mention has not been made of the differentiation of unilateral rotatory dislocation from an injury, to which I have lately directed the attention of the Clinical Society of London (*Transactions*, 1906 and 1907), namely, rotatory subluxation of the atlas. The distinction is difficult to make in some cases, as the complete dislocation differs from the partial only in the "quantity" of its symptoms, not in their quality. The subluxation is always reduced very easily when muscular relaxation is induced.

Treatment.—When a diagnosis has been arrived at, and the probable condition of the odontoid process ascertained, the question is whether to reduce the dislocation or not. If the accident has already happened for a fortnight to a month, or the odontoid process is thought to be intact, an anæsthetic may be given. In a number of the cases spontaneous reduction occurs when the muscles are relaxed. In others gentle traction on the head and rotation will bring about the desired result. The head can be put up in a plas-

ter of Paris collar or in wood wool and bandages, which will be succeeded in a few days by a poroplastic collar. If, on the other hand, the odontoid process is thought to be broken, keep the patient at rest in bed with the head immobilized with sand bags, and three weeks to a month later give an anæsthetic to examine the pharynx and reduce the dislocation.

Should the surgeon not reduce the dislocation, the neck is put into a poroplastic collar. Movements in the neck will return, but will be limited. Operative treatment, unless to relieve symptoms of pressure on the cord, is not likely to be of much use.

The following case has been published as an instance of rotatory dislocation of the atlas occurring in prehistoric man. It cannot be accepted as an example of this injury and may be regarded a romantic narrative.

XX. Rotatory Dislocation of the Atlas in Prehistoric Man. Baudouin. (*Compt. Rendu Acad. de Science*, Paris, 1904, cxxxix, 494–5).—A skeleton was found in a barrow at Vendée, which had a rotatory luxation of the atlas on the axis. It was a bilateral dislocation. As the skeleton was silicated whilst it lay *in situ*, and therefore before it was disturbed, the dislocation was thought to be the cause of death. The odontoid process was not broken. M. Lannelongue and others who were present at the séance at which the paper was read, thought that the dislocation had been brought about by the head turning with its own weight after decomposition had softened and loosened the muscles and ligaments. Thus the lesion was a post-mortem change and not an ante-mortem cause of death.

OCCLUSION OF THE PORTAL VEIN DUE TO SURROUNDING INFLAMMATORY ADHESIONS.

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On account of its rarity and surgical significance the following is of sufficient interest to be reported.

Female, age 67, family history negative.

Personal History.—Married at 17; four children; no complications. The patient has never suffered from any serious illness. During the past fifteen years she has had occasional attacks of what was thought to be indigestion; these were accompanied by gaseous eructations, slight abdominal pain, malaise and headache. There was no vomiting, no jaundice, no other disturbance. On January 1, 1900, the patient underwent a sudden and severe shock, owing to the death of her husband and daughter; after this she became very much depressed, noticeably lost flesh and became anæmic. The appetite was poor, sleep was disturbed, but there was nothing referable to any disturbance in the intestinal tract.

Present Illness.—On May 20, 1900, she was awakened early one morning by a severe pain in the right hypochondrium, which radiated towards the umbilicus and downward toward the pubis. The pain was moderately severe, somewhat paroxysmal in type and lasted for two hours, but was entirely relieved by five grains of phenacetin. There was no vomiting. Several hours later the pain returned with increased severity, but fifteen drops of the tincture of opium relieved it entirely.

According to the statement of her physician there was some rigidity of the muscles in the upper half of the right side of the abdomen, and over this area there was tenderness on pressure. There was no tumor mass to be felt. Constipation was present at the time and was complained of for some days following. There was no jaundice at any time. After this the patient lost flesh very rapidly; her appetite became poor; she suffered with constipation, alternating at intervals with attacks

of diarrhœa. There was no pain subsequently complained of, but on deep pressure in the right hypochondrium there was tenderness. Four weeks after the attack fluid was first noticed in the peritoneal cavity; this rapidly increased, the loss of flesh continued, the exhaustion became more and more marked and the constipation more obstinate.

Six weeks after the onset of the swelling—ten weeks after the attack—I first examined the patient. The abdomen was very markedly distended with fluid; respiration was distinctly interfered with; the muscle wall was everywhere soft and examination disclosed nothing but the large amount of fluid. The heart and lungs appeared normal; the temperature was normal, the pulse was 92, regular, but poor in volume. The tongue was slightly coated and the mucous membranes were pale. The face while distinctly emaciated was of a remarkably good color; there was no evidence of cachexia.

Urinalysis.—1100 cc. in 24 hours. Acid, pale straw color, specific gravity 10.22, no albumin, no sugar, no blood, no pus, a few epithelial cells, triple phosphates and urates in small quantity, no bile.

Stools: Soft, normal color, normal odor, no undigested food, no free fat.

A specimen of blood was taken, but owing to an accident the examination was not completed.

Six litres of a clear, pale straw-colored fluid were withdrawn from the abdomen. It was of a slightly reddish tint; there were no cheesy particles nor debris. Microscopic examination revealed a large number of red corpuscles; the fluid clotted readily. After removal of the fluid no change in the liver dulness could be made out, the lower border of the organ could be felt, it was smooth and regular. On deep palpation no mass could be felt, but there were tenderness and muscular rigidity. The spleen was not palpable, the dulness was not increased; neither kidney could be felt.

In a short time the fluid began to return and after five weeks three litres were withdrawn. This fluid contained no blood. Ten days afterwards the patient died.

A partial autopsy only was permitted. In the right hypochrondrium a palpable mass was found as soon as the hand was inserted. This proved to be an inflammatory growth about

the size of an orange, which matted together the duodenum, the head of the pancreas, the gall-bladder and the under surface of the liver. This mass surrounded the portal vein and common duct. The duct was patent, but the portal vein was pressed upon for about three-quarters of an inch and entirely occluded; behind and before the occlusion there were definite thrombi. The gall-bladder contained about 20 cc. of a turbid fluid and three irregularly shaped gall-stones about the size of hazelnuts. The wall was very much thickened and the mucous lining roughened. The cystic and common ducts were patent. The liver was of normal size and except that it presented the appearance of chronic passive congestion there was no change. The stomach and duodenum were not opened; they were not distended. A section of the pancreas appeared to be normal. The kidneys were not examined nor was the chest opened.

While it cannot be definitely stated what was the cause of this mass, it is probable that it was due to a pericystitis, resulting from a long continued inflammation of the gall-bladder. It is possible that a perforation by one the stones may have occurred, but there was no evidence to prove this assumption. This inflammatory mass with its subsequent cicatrical contractions had caught and finally occluded the portal vein.

The ill-defined attacks of indigestion which had been complained of for fifteen years previously were probably due to the gall-stone and inflammation of the gall-bladder. During the last attack something happened which allowed the surrounding inflammation to occur and formed the starting point of the inflammatory mass. This in turn by its occlusion of the portal vein interfered with the intestinal circulation, and caused the ascites and other symptoms noted during life.

An exploratory operation was thought of, but the extreme emaciation, anæmia and exhaustion present when I first saw the patient seemed to contraindicate any operative interference.

OBLITERATION OF THE STOMACH AS A RESULT OF GASTRIC ULCER—DUODENOSTOMY.

BY JAMES B. BULLITT, M.D.,

OF LOUISVILLE, KENTUCKY.

P. R., male, age 40, was quite well and normal up to June 15, 1901, when he had a severe pain in stomach immediately after swallowing food, which persisted until the stomach was emptied by vomiting. From that time on he had constant pain in stomach whether the organ was empty or full. There was constant vomiting. There was no blood in vomitus or stools at any time. In the summer of 1903 he entered St. Edwards' Hospital, New Albany, and came under the care of Dr. Charles P. Cook. At that time there was manifest pyloric obstruction, the stomach outlines and washings showing marked dilatation. No tumor could be palpated. The stomach was washed out daily for two weeks, preparatory to a proposed operation of gastro-enterostomy, the patient gaining 15 pounds in this time. The patient felt so much improved that he left the hospital, refusing operation.

He was again seen in August, 1905. At this time, on making efforts to wash out the stomach, it was found that the tube could not be made to enter the stomach. The patient began to have great difficulty in swallowing food. He first gave up solids and semi-solids, and was finally reduced to only a teaspoonful of liquid at a time. Vomiting of ingested matter and mucus was continuous.

He finally came to operation on November 27, 1905. For four weeks before this time he had retained practically nothing at all by stomach.

The abdomen was opened in the mid-line, between ensiform and umbilicus. The stomach was exceedingly difficult of identification. A mass, the size of a medium-sized oyster shell, was detected buried in adhesions and occupying the site where the stomach should be. This was finally identified as the stomach by passing the stomach tube by mouth, with the mass between the fingers. The tube could be felt to enter its center, its intro-

duction being attended by the discharge of about a tablespoonful of evil-smelling liquid. The cavity of the stomach seemed to grasp the tube with some firmness. The mass representing the stomach was hard and smooth rather than nodular, and, as already stated, was buried in adhesions.

The alternatives of attempting a gastrectomy in the face of the adhesions, or making an enterostomy, presented themselves. The latter was determined upon. A small slit was made in the descending portion of the duodenum, large enough to admit a small-sized stomach tube. The tube was then inserted and buried in the wall of the duodenum for about two inches; the parietal peritoneum was sutured to the intestine along this same line. The incision was closed up to the tube, which came through the incision at about its middle, being essentially the method employed by Witzel in making a gastrostomy.

The patient immediately received milk and broth through a funnel attached to the tube.

In the ten months since operation his weight was increased from 90 pounds to 130. His normal weight was 145 pounds. He eats everything, including meats, cabbage and sauerkraut. The food is taken into the mouth, chewed thoroughly until finely divided; a little coffee, tea or other liquid is then taken into the mouth, and then the whole mouth contents is directed into a funnel connected to a tube previously passed about six inches into the artificial mouth.

At first, immediately after the operation, an occasional slight diarrhœa occurred. For many months digestion and bowel function have apparently been uneventful.

There is practically no leakage from the fistula. The patient keeps a rag stopper in the opening between feedings, in order to keep the opening dilated. Otherwise, there is pain on introducing the tube. About six meals are taken daily.

For a time after operation when hunger was felt patient would occasionally try to swallow food. There would immediately be a sense of fulness and distention, evidently of the lower end of the œsophagus, and thereupon the ingested matter would be ejected. These efforts have long since been given up entirely. Every evening the gullet is washed out by taking a swallow of

water: this is immediately ejected, bringing with it a small quantity of mucus.

The condition presented in this case constituted a practical obliteration of the stomach. I think there can be no doubt that the process was one of chronic ulceration, with gradual contraction and so obliteration, attended by the formation of extensive adhesions around the stomach.

In making an enterostomy under such circumstances it is manifest that the higher up, the closer to the pylorus, the opening can be made, the better. In this case the cutting out of the stomach seems to have had no appreciable effect on the process of digestion.

In the early days of feeding, before the patient took the food into the mouth before injecting it through the tube into the duodenum, diarrhœa resulted. Since the food has been first taken into the mouth the bowel movements have been always soft and otherwise natural.

With the exception of this man's social disability, his necessity of isolating himself at feeding time, and the further necessity of more frequent feedings, he is comparatively as well off as if he had a pervious stomach. He states that the feeling of hunger is immediately relieved on receiving an injection of food.

The patient's future has been given careful consideration. Sufficient proof has been offered to cause an apprehension of cancer growth on every ulcer base, and this is certainly a possibility worthy of consideration in this man's case. As no food will come in contact with and continually pass over the sites of old ulceration, it seems reasonable to assume that the danger of ultimate cancer growth would be less in this case rather than greater.

Further operation in this case, gastrectomy with anastomosis of jejunum with œsophagus, would be extremely difficult and hazardous, owing to the stomach remnant being buried in such extensive and dense adhesions. It would probably be possible of performance. In such event

it would unquestionably be best to cut the jejunum square across, anastomosing the distal portion with the œsophagus, and implanting the proximal end in the side of the coil anastomosed with the œsophagus. The present artificial mouth could be then used advantageously for a time, and could be ultimately closed.

The patient's general condition is so good, and the outcome of such possible surgery so uncertain, that I have advised him, for the present at least, to bear the ills he ha rather than risk others he knows not of.

TYPHOID WITH DOUBLE PERFORATION OF ILEUM AND PERFORATION OF GALL-BLADDER.*

INTESTINAL SUTURE. CHOLECYSTECTOMY.

BY OTTO G. T. KILIANI, M.D.,
OF NEW YORK.
Surgeon to the German Hospital.

On July 24, 1906, a patient, H. W., forty years of age, German, single, was admitted to the medical ward of the German Hospital with the following history:

The patient was too sick to inquire into family and previous history. For four weeks past he had complained of indefinite abdominal pain, diarrhœa, drowsiness and weakness; appetite has been poor. He has not vomited, no cough, no dyspnœa, no icterus, no night-sweats, no palpitation, normal urination. Eyes and ears normal. Temperature 104.4°, pulse 116, respiration, 28.

He was a poorly nourished male; face flushed, tongue coated thickly. Lungs: slight dyspnœa; no dulness, few rales over right base, subcrepitation. Heart: borders not enlarged. Abdomen: slight rigidity, marked tenderness on right side of abdomen, especially under right costal margin; slight rigidity of muscles over liver. Liver dulness reached 2½ inches below costal margin. Spleen palpable, soft, round edge; kidneys not palpable. Extremities negative.

Diagnosis.—Typhoid fever. Examination of the urine showed that through the entire disease practically normal conditions existed, except faint traces of albumin. Diazo stayed negative throughout. A few hyaline cylinders (casts).

Examination of blood, July 24:

Polynuclears.....	72 per cent.	RBC, 3,600,000.
Lymphocytes.....	19 per cent.	WBC, 5,600.
Mononuclears.....	4 per cent.	Hb, 75 per cent.
Eosinophiles.....	0 per cent.	Widal, 1–50, negative.
Basophiles.....	2 per cent.	
Transitionals.....	3 per cent.	

*Read before the New York Surgical Society, October 24, 1906.

The case was accepted as suspicious of typhoid (ambulatory), and was especially carefully watched, as is the rule in the Hospital with these cases. The man had been admitted at 4 P. M. Next morning, July 25, at 2.30 A. M., about eleven hours after admission, the patient suddenly complained of extremely severe pain in the abdomen, as if he were being knifed, (douleur à poignard) and became extremely restless. The temperature within two hours dropped to 99.8°; the pulse also dropped from 116 to 92. The night nurse reported the patient's condition to the house surgeon, who informed me, so that I saw the patient within thirty minutes of the sudden onset of pain. The abdomen showed absolute rigidity (rigidité de défense). The patient having received Magendie, no longer complained of much pain. In spite of the low leucocytosis, 5,600, in spite of the low pulse, 92°, I made the probable diagnosis of intestinal perforation, solely on the strength of the sudden drop in temperature, the very distinct sudden sharp pain and the abdominal rigidity.

As there seemed to be very little shock, I decided upon immediate operation, against the general advice to wait if possible for twelve hours. Within twenty minutes operation was performed under anæsthol narcosis. Incision in the right rectus about 5 inches long, between umbilicus and symphysis. On opening the peritoneum a large quantity of yellowish fluid of slightly fæcal odor was found in the general abdominal cavity. A number of small yellow fæcal flocculi were to be seen on the intestines, which were of bright red color. The glands in the mesentery were plainly enlarged. In handling the small intestine near the colon, the thickened Peyerian patches could be distinctly felt with the fingers. About 10 inches from the ileocæcal valve, two small perforations of the intestine were found, one complete and typical in its appearance, while in the other the ulcer seemed not to have perforated completely; nevertheless the probe found easy access into the lumen. Both perforations were closed with a number of fine silk Lembert sutures. While thus the operation was apparently finished (it took up to this point about twenty minutes), the very unusual bright yellow color of the abdominal fluid, which must have amounted to about a quart and a half, induced me to lengthen the incision in the rectus up to the costal margin. Immediately the gall-bladder presented itself, of a length of about 5 inches, with

a gangrenous fundus, showing two small perforations permitting the introduction of a medium-sized silver probe. The gall-bladder held rather closely two gall-stones of the size of hazelnuts. Cholecystectomy was performed in a few minutes, not presenting any technical difficulties (gall-bladder and cystic duct excised). The ligated stump was cauterized, a small gauze tampon put on the stump, another one in the lower angle of the wound over the intestinal sutures, the omentum placed as an apron over the sutured gut, and the entire abdominal wound closed. The operation lasted 45 minutes. The patient was brought to bed in very good condition, with pulse of good quality.

Blood examination, July 29:

Polynuclears.	72 per cent.	RBC, 4,800,000.
Lymphocytes.....	20 per cent.	WBC, 7,400.
Mononuclears	8 per cent.	Hb, 80 per cent.
Eosinophiles	0 per cent.	Widal, 1–40, positive.
Basophiles.	0 per cent.	

July 29.—Cultures from gall-bladder: typhoid bacillus and coli.

July 30.—Blood cultures: bacillus typhosis in pure cultures.

The patient's temperature rose the day after operation. July 26, to 102.8° with a pulse of 124; on the 27th to 105°, with a pulse of 140; on the 28th to a temperature of 105.4°, with a pulse of 160; he continued to have temperatures for the next ten days between 104° and 105°; on the thirteenth day after operation remissions set in, the temperature varying between 103° and 100°, and the pulse between 120 and 112.

The man showed on the 28th and 29th symptoms of double broncho-pneumonia, with isolated areas of dulness over the left lung and dull tympany on right lung anteriorly from the fifth space to the eighth rib, below which flatness. Abdomen slightly distended, somewhat firmly held, not tender. Liver palpable 8 cm. below costal margin; edge sharp, smooth, not tender; jaundice clearing.

July 29.—Peritonitic facies continues; temperature 106.2°; general condition fair; tampons removed, not replaced; moderate drainage.

August 1.—General condition, good; took his nourishment

well; well retained; expels flatus freely; wound approximation good; moderate redness and induration about suture orifices; abdomen soft, not tender.

August 8.—General condition, fair; evening temperature still rises high; respiration rapid and shallow; nocturnal attacks of dry cough; icterus clear; took nourishment well; abdomen somewhat distended, soft, not tender; small granulating surface at the site of the two tampons, upper and lower angle of wound; remainder of wound healed solid per primary union; sutures removed.

August 10.—Right lung; dulness below sixth, flatness below eighth rib posteriorly; high-pitched bronchial breathing; many moist bubbling rales; sputa scant, brown, viscid, not fetid.

From Aug. 12 on, the condition became markedly worse; the patient died on the 16th of sudden cardiac collapse, with a temperature of 99.2° and a pulse of 136, twenty-one days after operation.

Extract from Autopsy Record, Aug. 17, 1906.—Abdominal incision almost completely healed, extends from 1 inch beneath ensiform process to 2 inches above symphysis; no other scars; no pigmentation, no œdema, no jaundice. Abdomen distended.

Thoracic cavity: situs normal.

Pleural cavity: (*a*) Right, filled with 12 oz. of turbid yellowish purulent fluid, pleura very much thickened and adherent posteriorly. (*b*) Left, contains several drachms of clear serous fluid; no adhesions.

Lungs: (*a*) Right. (1) Upper lobe: apex shows several old calcareous foci, also several small tubercular cavities surrounded by connective tissue; besides this, a large focus of gangrene. (2) Middle and lower lobe congested. (*b*) Left. (1) Upper lobe: apex in similar condition as on right side. (2) Lower lobe congested.

Pericardium normal. Heart, slight myocarditis; heart muscle somewhat pale and flabby; no valvular lesions. Thoracic duct normal.

Abdominal cavity. Intestines: Small intestine presents a volvulus, comprising about 1 inch of intestine, the lower end 6 inches from ileocæcal valve; intestine above markedly distended with gas, below collapsed; the part involved, purplish; peritoneal covering glistening; no evidences of intestinal sutures can be found; the mucous membrane shows no evidences of ulceration except about 1 inch from large intestine two small round ulcers one-half the size of a split pea, punched out in appearance, margin not raised, base smooth.

Stomach normal; liver slightly enlarged and congested; gall-bladder absent, cicatricial connective tissue in its site; bile duct patent; spleen

congested, firm and enlarged, (8 x 4 x 4 inches), anterior margin shows two notches.

To sum up, we have here a case of unquestionable typhoid, proved by Widal being positive, by pure cultures from the blood, by anatomical condition of small gut observed during operation, and by culture of typhoid bacilli from extirpated gall-bladder (the latter proof not being absolutely conclusive, as typhoid bacilli have been found from three to four years after typhoid had been contracted).

The case is of the so-called ambulatory type, probably at the end of the fourth week, possibly later. Ten hours after admission, laparotomy is performed, as the diagnosis, intestinal perforation, is made. I must add here that owing to the rigidity of the abdomen at the time of my examination before operation, I could neither feel the enlarged liver nor the tumor of the gall-bladder with its stones. As it was night, the jaundice was not particularly observed. The operation revealed double perforations of ileum near the ileocæcal valve, which were closed by sutures, and perforation of gall bladder, which contained two large stones; the gall-bladder was extirpated. The patient stood both operations remarkably well, overcame his peritonitis and lived through his violent type of typhoid to die twenty-one days after operation, of gangrene of lungs and empyema, both probably of tubercular origin.

As to the diagnosis of perforation, a few words are to be said. If the case had been under observation longer, and not only ten hours, as was the case, the diagnosis of perforation of the gall-bladder might have been thought of. Whether anybody would then have thought of intestinal perforation besides, is questionable. I think, generally speaking, as well as under the existing conditions, one has every reason to be satisfied if perforation as such is recognized early enough. Cushing, Russell, Osler and others have called attention to the point that the status of leucocytosis is an exceedingly unreliable diagnostic point. In our case it proved to be only 5,600; besides this,

the pulse, instead of being, as typical, very high, contrasting with the low collapse-temperature, was also low, viz., 92. But this meant to me simply that the man had not developed a peritonitis as yet. Altogether I based my diagnosis of abdominal perforation mostly on the sudden, very marked pain, combined with a fast drop of temperature and rigidity of the abdominal muscles. As Osler says, one must operate when one has a probable diagnosis. To wait till all the symptoms of perforation are established, means to kill the patient. "Ce sont les medications qui tuent, par le temps qu'elles font perdre."—Lejars.

As to the sequence in which the perforations occurred, whether the gall-bladder or the intestine showed perforation first, with its influence on the abdominal cavity,—I dare not offer an opinion; nor about the point, which perforations produced the violent symptoms leading to an operation. We must be satisfied with the proven fact that in a case of typhoid the gall-bladder and the small intestine were perforated practically simultaneously.

One point of the post mortem needs explanation, and that is the volvulus which was found at the time of the autopsy. The report of the pathologist as well as the verbal report of Dr. H. Fischer, my adjunct surgeon (I myself was not present), indicate that the volvulus was not complete, so as to be fatal; it was somewhat permeable. Whether its formation had anything to do with the intestinal sutures —of which no signs could be found—is an open question, but deserves our attention. Theoretically, the possibility cannot be denied, that the suturing of two holes in the gut only a few centimetres distant from each other, might produce a kink, which could eventually lead to an incomplete volvulus.

As far as accessible to me, I have looked up the entire recent literature on operations in typhoid complications, and have been unable to find a case like the one I have reported. There is one case reported in the *Philadelphia*

Medical Journal, 1901, by Hermann B. Allyn, where a typhoid case (admitted probably in the second week) was operated ten days after admission for intestinal perforation. The perforation in the gut was not found, nor a perforation in the gall-bladder, although its region had been examined digitally. The patient died three days after operation of peritonitis. The autopsy revealed an opening 1 cm. in diameter in the gall-bladder, communicating with a small opening in the hepatic flexure of the colon, 5 mm. in diameter. I mention this case only for the sake of completeness, as it has very little in common with my own. The simultaneous perforation of gall-bladder and colon was apparently produced by a contact infection, the perforations were both not found during operation, and the patient died of peritonitis.

Erdmann, in his paper on primary typhoid perforation of the gall-bladder, read before this Society in February, 1903, had collected up to that time seven cases of perforation of the gall-bladder which had been operated upon, of which four cases recovered.

While the literature of intestinal perforations in typhoid has increased considerably in the last years, reports on perforations of the gall-bladder have been very scarce,—we find one by Park Weed Willis, Seattle, Washington, in *Northwest Medicine*, 1904, where perforation of the gall-bladder was found, and the perforated gall-bladder, containing no stones, was stitched into the abdominal wall. The patient died two weeks after operation of peritonitis, which the author ascribes to obstructions from adhesions, for which he operated shortly before death. His description of the case does not prove to me that the peritonitis was due to adhesions, but rather to his failure to extirpate the gall-bladder at the first operation.

Zesas, in his extensive paper pubished in the *Wiener Klinik*, 1904, "Ueber die Resultate der chirurgischen Therapie der typhösen Perforationsperitonitis," gives statistics of 250 cases operated for perforative peritonitis,

with 95 recoveries, but no perforation of the gall-bladder is to be found among them.

As stated above, a rather careful perusal of the American, English, German and French literature since 1903 has failed to show any further publications reporting operations for perforation of the gall-bladder in typhoid, while an operation for apparently simultaneous perforation of the gall-bladder and ileum in typhoid seems to be unique.

INTESTINAL INTUSSUSCEPTION.*

BY ROBERT C. COFFEY, M.D.,

OF PORTLAND, OREGON.

Surgeon and Medical Director of the North Pacific Sanatorium.

INTESTINAL intussusception is one of the last of the serious intestinal lesions to yield good results by surgical means, and yet the very nature of the trouble makes it purely a surgical disease. The general mortality of this malady has been variously estimated at from seventy per cent. to ninety per cent. and modern surgery has not so far lessened it to any great degree. This, I believe, is due to the fact that we are relying largely upon the mortality tables of the older operators which were compiled before the inauguration of modern methods in intestinal surgery. A few years ago some authorities estimated mortality of gastro-enterostomy at thirty per cent., or considered an intestinal excision as an exceedingly serious matter. To-day the mortality of these operations in the hands of surgeons doing a great deal of that work is not materially greater than the operation for appendicitis. The great diminution in the death rate in this latter class of cases is due, first, to the fact that formerly the conditions were not diagnosed until the patient was moribund. Secondly, the technical methods of operating were deficient. Now the diagnosis is made earlier, while the patient yet has vitality, and the operation is done more skilfully—hence the lessened mortality. The conditions mentioned above, which existed in stomach surgery ten years ago, still exist in relation to acute intestinal obstruction. Progress in the treatment of this class of cases has been delayed longer than in stomach cases because of the acuteness of the condition, thus depriving the practitioner of time for deliberate study of his case and preventing his making a diagnosis until the vital-

* Read before the Idaho State Medical Society, October 5, 1906.

ity of the patient is exhausted, while diseases of the stomach and gall-bladder are usually chronic and allow time for deliberation and investigation. Intestinal intussusception, or invagination, which comprises more than thirty per cent. of all acute intestinal obstructions, is more fatal than other forms of obstruction because of greater difficulty in making an early diagnosis. In most other forms of intestinal obstruction, the occlusion of the lumen of the bowel is almost or quite complete, which is not the case in intussusception. The one misleading feature in intussusception is that in a great many cases the obstruction is not complete and the bowels act, gas passes and there is little or no distension. Another reason for the great mortality is that it most frequently occurs in children, and the practitioner is at a loss to differentiate between this condition and an ordinary gastro-intestinal disturbance or colic; for before he is called some one has given a large dose of castor oil which may have been effectual. Thus the doctor is misled until the patient is almost dead; an infant is a poor subject in acute abdominal diseases for surgery.

Without going into detail I think we can say in a general way that the three most frequent causes are, (1) A congenital laxness of the structures in the neighborhood of the ileocæcal valve.* (2) A partial or complete intestinal obstruction by a growth or some form of constriction. (3) The presence of a pedunculated tumor within the lumen of the intestine. All these causes are made effectual or active by the normal peristaltic action of the intestine, which tends to grip any foreign or unusual body and force it on down the intestinal tract. It has been my fortune to have seen quite recently, cases of intussusception produced by each of these causes. I may mention two cases of the first type.

One was a three-year-old child in which there was not more than an inch of invagination. There was very little ob-

*This the writer has studied with interest in intestinal experiments in which the motor nerves of the intestine had been cut, thereby producing paralysis and intussusception.

struction and almost no trouble in reducing it. The symptoms were nausea, vomiting and pain in the neighborhood of the umbilcus, which symptoms had existed for several days. Marked marasmus existed. Cathartics, however, produced results. The diagnosis was not made positive until the abdomen had been opened. The intussusception was easily reduced and the intestine was sutured to the mesentery, thus partially rolling the intestine up in its mesentery, as shown in Fig. 1., to prevent recurrence of intussusception. Patient recovered.

Another case was one in which the patient was nine years old and in which the cæcum, appendix and ileocæcal valve had formed an intussusception. This was very acute and had only existed a few hours. The condition was so acute as to require the services of a physician from the very beginning. The patient suffered with great pain and distress, resembling an acute appendicitis, but as there was a decidedly palpable tumor so soon after the onset of the attack, we were able to rule out appendicitis. It was easily reduced and the cæcum was sutured to the peritoneum in its neighborhood, as recommended by the authorities, and the ileum was rolled up in its mesentery as shown in Fig. 1. Patient recovered.

The third case was that of a Chinaman about fifty years of age. This was due to the second cause mentioned above. I was called in consultation with Drs. Locke and Gullette. The patient had had no action of the bowels for thirteen days and was in an extreme condition. Within twenty-four hours preceding operation a tumor was discovered protruding through the anus which examination proved to be the apex of an intussusception. We did an abdominal section, and, by pushing up from below through the rectum, we were able to reduce the intussusception but found practically a complete obstruction which proved to be a carcinoma involving almost the entire circumference of the gut at the sigmoid flexure. So we did an incision and an anastomosis which was very effectual, as was shown by his passing a large quantity of dark malodorous fæcal matter by the anus at once. He lived for more than two days and then died of stercoræmia and peritonitis. While this was a very desperate case, I feel that if I were doing another case, I would not perform the operation in exactly the same way, but would prefer to do it in two stages. The point I wish to illustrate by this case

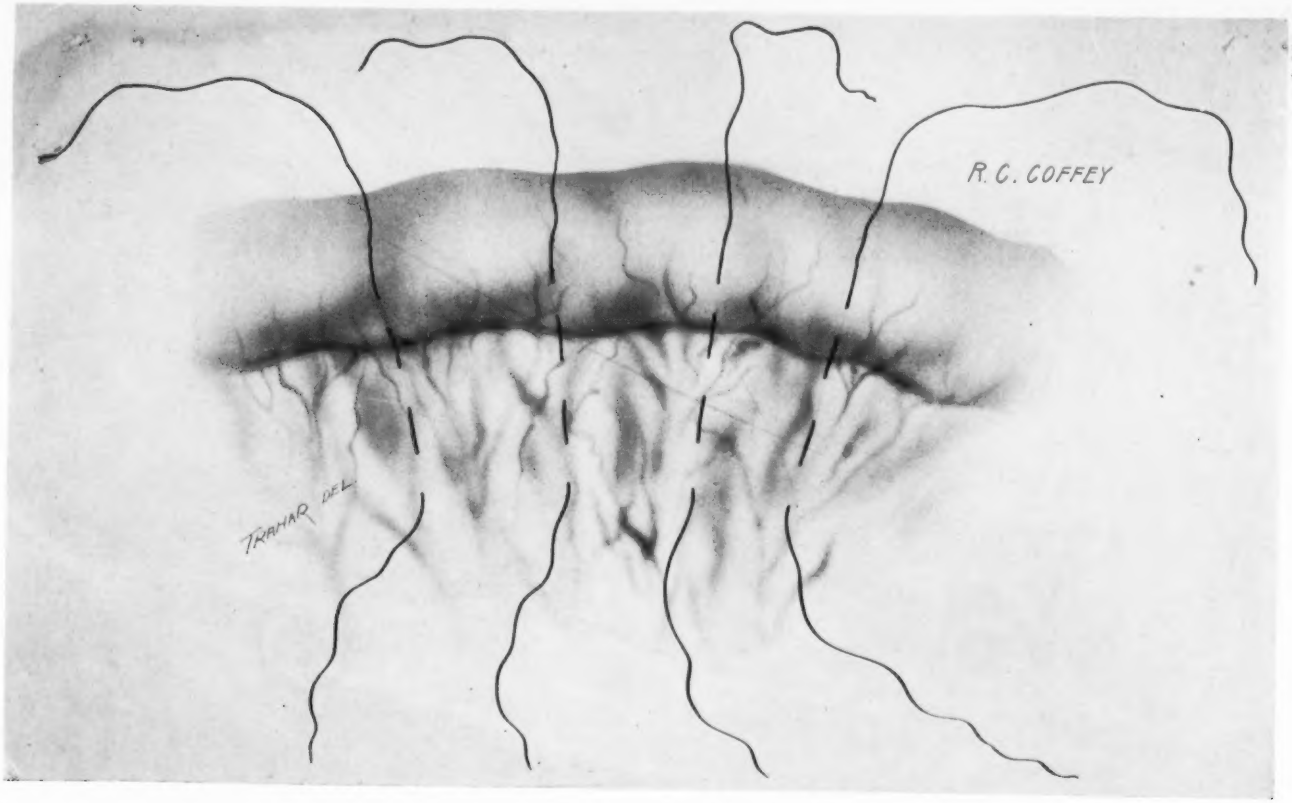

FIG. 1.—Rolling intestine in its mesentery to prevent recurrence of intussusception.

is that a movable tumor, even though it is in the form of a stricture, is a prolific cause of intussusception, especially if in the region of the sigmoid flexure.

The last case which I wish to relate, and which was the subject from which the accompanying pictures were made, is a classic one in many ways. I have therefore attempted to illustrate it. Fig. 2 illustrates the pathological conditions existing. The case has several ideal features as far as description is concerned. First, it is a simple and yet extensive intussusception and involves that part of the intestine most frequently affected. Second, it has the most ideal cause, viz., a pedunculated growth within the intestine on which the peristaltic wave may act. Third, this particular growth happens to be a structure which has often hitherto been overlooked (a Meckel's diverticulum), which in this instance was inverted. (Authorities generally agree that a Meckel's diverticulum is present in some form in two per cent. of all human beings; therefore it is probably the cause of more cases of intussusception than we have recognized.) Fourth, it is ideal in its pathologic termination, viz., gangrene was produced. Fifth, it was ideal in that the lumen was still patulous despite its great length. Sixth, we used what in my opinion is the ideal treatment for a gangrenous intussusception (radical removal), notwithstanding the reports of most of the operators indicate its inadvisability. The history of the case is briefly as follows, as related by the patient's mother.

Patient aged 7 years. When he was two years old he had severe cramps, with cold perspiration standing out on his face and body, lasting about thirty-six hours. During the attack, enormous doses of cathartic medicines were administered, most of which were vomited. Finally an action was produced which contained quantities of blackberry seeds, and to their presence was attributed the attack by the physician and the people. During this attack he vomited every few minutes. From this time he had an attack about every month, varying in severity, but one striking feature was that he always passed blood at every

attack. Sometimes his attacks would occur every week. This state of affairs kept up for four years, when he had a very severe attack, with jaundice, and passed a lot of blood. This attack, which was about one year ago, began at 7 A. M (and we may here state that all the attacks began at this time of day). In the afternoon at 6 P. M. he was better, and was better the next day. He never had fever during any of these attacks. From this one, just described, to the beginning of the present, he had light spells, no blood passing. Three weeks prior to this final attack, he had one which was quite severe, but which lasted only a few hours. This time he did not vomit but was nauseated.

On Sunday, June 8, 1906, he had a very severe attack, screamed with pain, had great pallor, and cold perspiration. Vomited every few minutes during the day. Was better, apparently, at 4 P. M. when cramps ceased, but vomiting continued until 7 P. M. Then he was hungry and was given bread and milk, but the soreness in his bowels did not cease as usual, and on Monday he remained in bed with but little appetite. On Tuesday he was still sore but was up a portion of the day, his bowels acting without a cathartic. Wednesday he played vigorously and was apparently as well as usual. Friday morning at 7 A. M. he was seized with a very severe attack, similar to the others, when his mother began to give castoria in large doses but found it was not effectual as it had been in previous attacks. Dr. Alice Hall Chapman, of Woodland, Washington, was called at this time and arrived at 12.30 P. M., remaining for two hours, injecting salts, castor oil, etc., and finally suspending him by his feet for an hour to cause the enemata to go high in the bowel. Finding this inefficient she advised them to bring him to the hospital, which, owing to the out-of-the-way place and poor facilities for travel, required a good deal of time to reach Portland. On the way to the hospital his bowels acted and he passed some gas and very dark fluid and fæcal matter, but nothing that could be identified as blood. After this he had no pain. He arrived at the hospital at noon, Saturday, June 14.

On admission he presented sunken features and the characteristic expression of a serious abdominal trouble. There was no distension. A large mass was palpable on the right side extending up under the ribs. He was taken immediately to the operating room and the abdomen opened. The intussusception

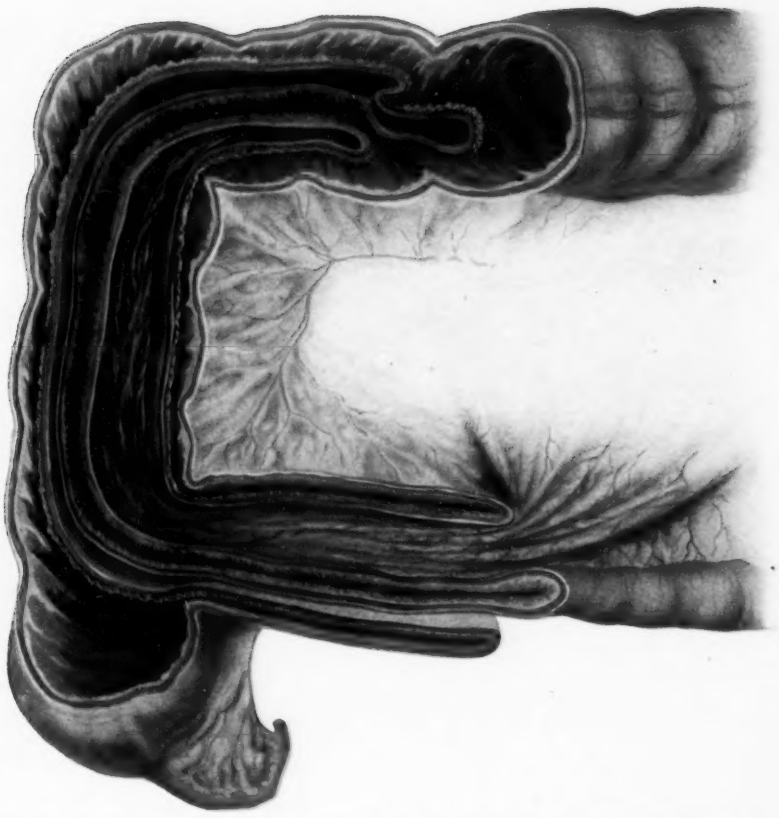

FIG. 2.—Sectional view of extensive gangrenous intussusception, due to an inverted Meckel's diverticulum.

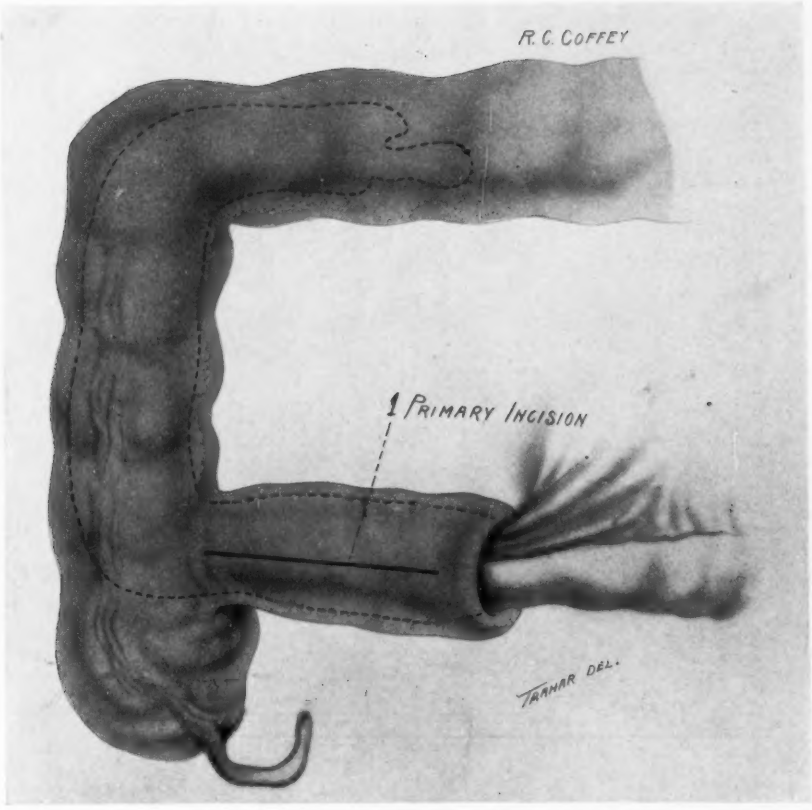

FIG. 3.—Diagram showing incision through which intussusceptum was removed (indicated likewise in succeeding pictures).

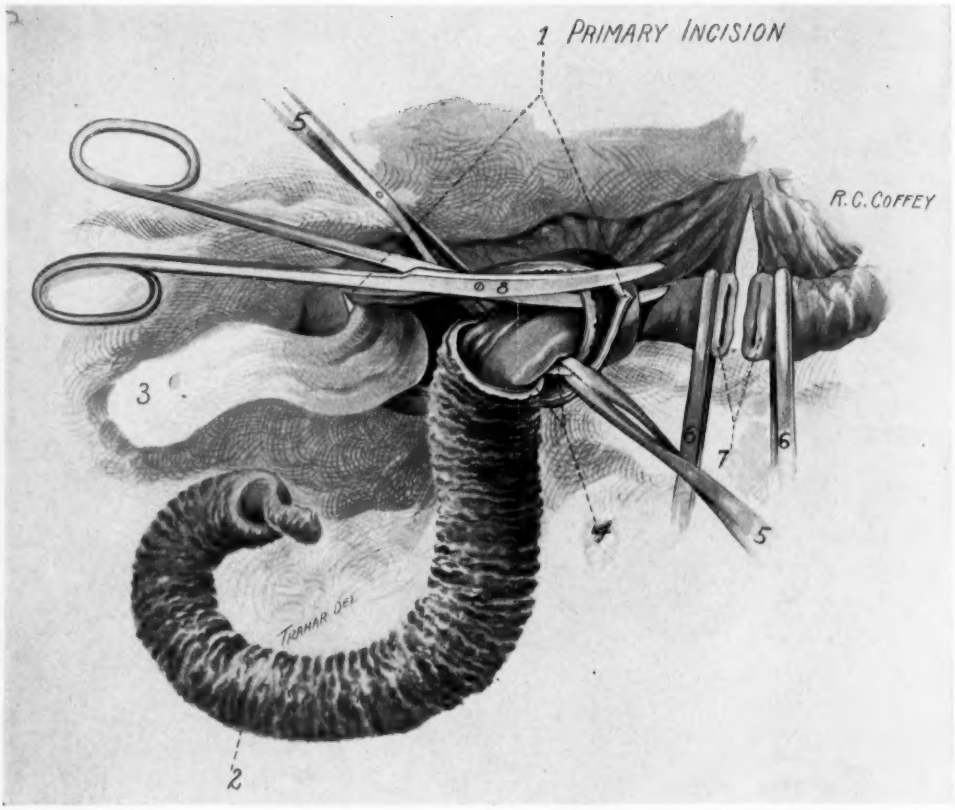

FIG. 4.—Steps in operation. 1. Make primary incision indicated in Fig. 3. 2. Withdraw intussusceptum and wrap in gauze. 3. Pack distal end of intestine with gauze. 4. Cut middle layer of intussusceptum by circular incision. 5. Catch bleeding arteries with forceps. 6. Clamp healthy intestine with two forceps. 7. Cut between forceps. 8. Complete primary incision, laying open distal end of the ileum and freeing intestine to be removed.

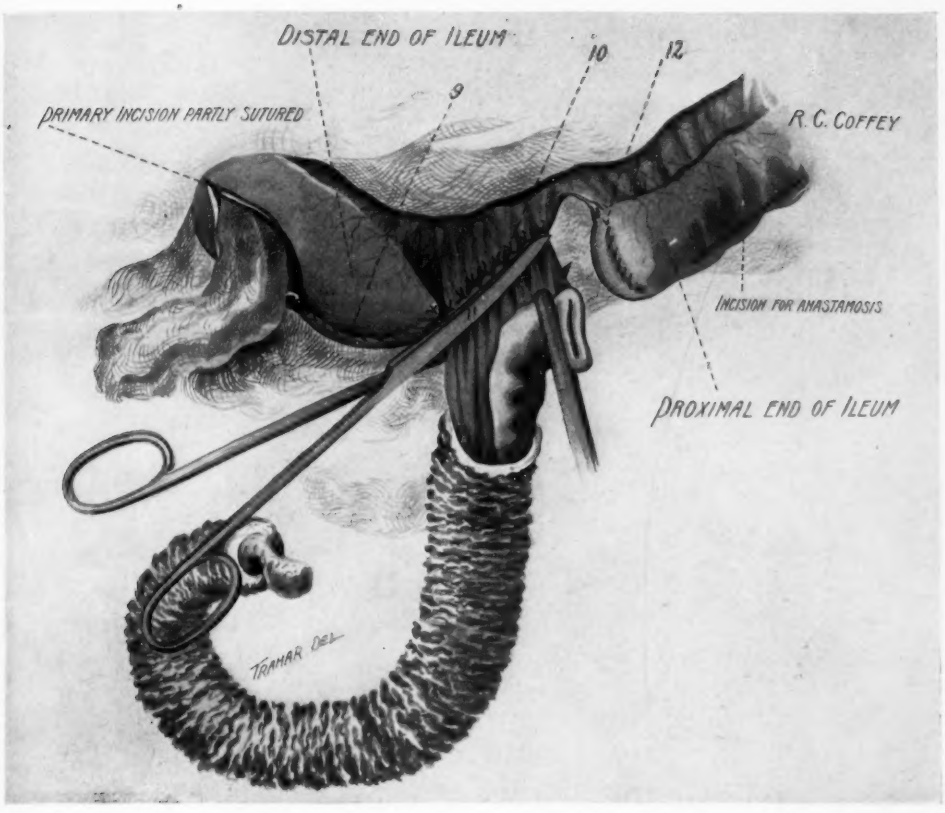

FIG. 5.—Steps in operation. 9. Partly suture distal end of the ileum. 10. Ligate mesentery in sections. 11. Cut mesentery and remove gangrenous intestine. 12. Suture proximal end of the ileum.

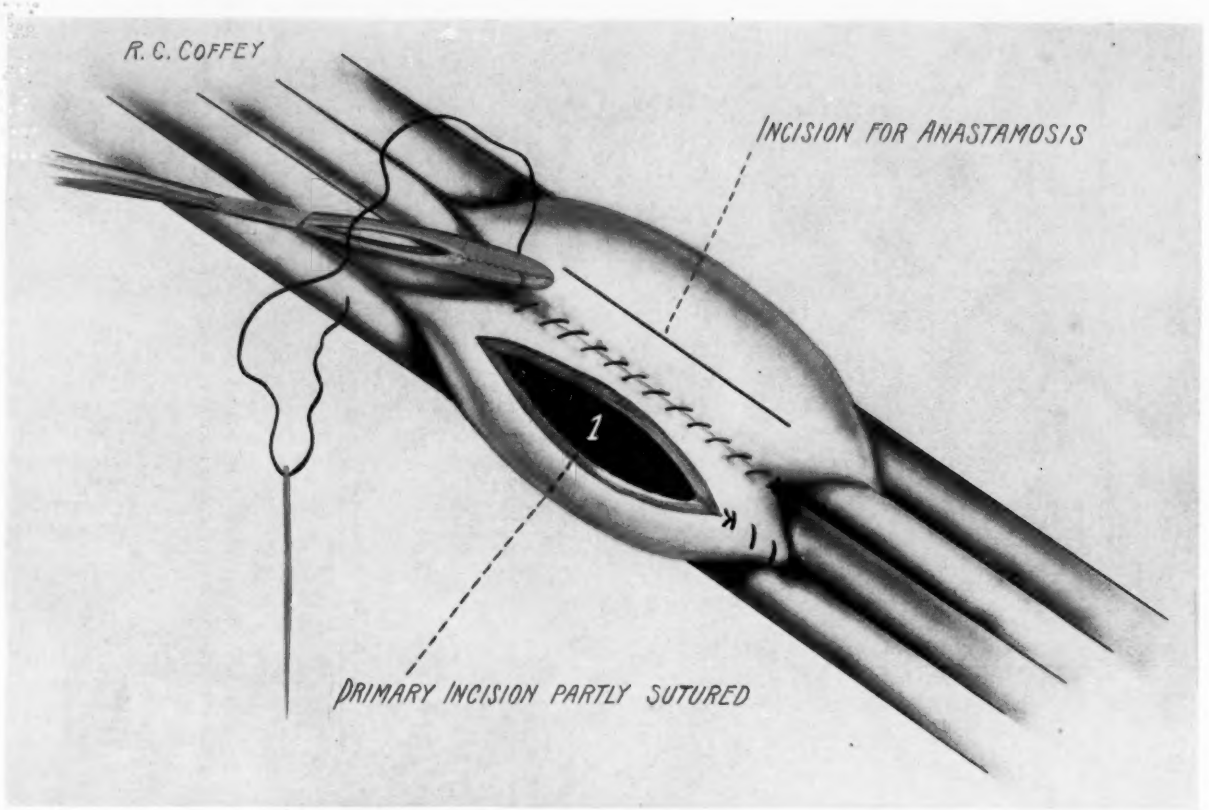

FIG. 6.—Make lateral anastomosis between the proximal end of the ileum and the distal end of the ileum at the primary incision by the method usually used in doing gastro-enterostomy.

shown in the picture was found and identified. The abdomen was packed full of gauze to prevent exposure of the other intestines. We then tried for several minutes to reduce the intussusception but found it impossible; so after packing many layers of gauze and delivering the affected part of the intestine to the surface, we made the primary incision (1) as shown in Figs. 3 and 4, and mopped out all the fluid in sight. We found the enclosed intestine gangrenous and that there existed a constriction at the ileocæcal valve, necessitating a partial cutting of the valve. (2) The intussusception was then withdrawn and wrapped in gauze. (3) The fluid inside the intestine was mopped out with sponges and a long piece of gauze was packed into the cæcum to prevent regurgitition of intestinal contents. (4) The second layer of intestine was cut in two in its circumference. (5) The edges of the intestine were clamped at the bleeding point to control hæmorrhage. (6) The ileum was then clamped and (7) cut. (8) The cæcal stump of the ileum was slit wide open with scissors by extending the primary incision. (9) This was sutured partially, leaving an opening large enough for an anastomosis (Fig. 5.) After this the gangrenous portion of intestine was left hanging by its mesentery only. (10) This was ligated in sections and (11) cut with scissors. (12) The proximal end of the ileum was sutured and the clamps removed. The distal and proximal ends as indicated were brought together and an anastomosis was made with clamps, as shown in Fig. 6. The patient was not seriously shocked by the operation, but very small hopes were entertained of his living. The next day his temperature went to the neighborhood of 106°, which symptom is pointed out by Barker as being peculiar to these cases. This patient made a complete recovery and has remained so for four months.

For some reason radical operation has not been as successful as we would naturally suppose, and most of the cases of gangrenous intussusception are fatal. Barker has devised a means of cutting off the intestine within the intussuscipiens, suturing the peritoneal layers together as they lie in contact, and then suturing the edges of the peritoneum at the beginning of the intussusception. I believe it is not considered to be very effectual in gangrenous cases. This operation has found considerable favor in

the hands of most surgeons and is considered a good compromise between no operation and radical operation, but has the disadvantage that, even if the patient recovers, a stricture is likely to occur which finally requires a secondary operation or produces death. Treves states that cases where suturing has been carried out, whether gangrenous or not, have had a mortality of about 86 per cent. Concerning the gangrenous cases, Moynihan quotes Barker as saying "He had never seen recovery after resection in gangrenous cases and never expected to see it. The only hope lay in early operation."

We are prepared to agree with Mr. Barker that the only hope for greatly reducing the mortality in these cases is in early diagnosis and early operation, which, like appendicitis, if done in the first twenty-four hours is usually found reducable and with not a very large mortality, except in young infants. The harm is done by the use of cathartics and the temporizing with all kinds of remedies, hoping to finally avoid operation, when in reality the surgeon should be called as soon as the trouble is suspected. If the surgeon occasionally opens an abdomen in which there is no obstruction he will do very little harm. The results in this case here related have strengthened the belief that I have held for some time that there should be no great difference in the excision of a gangrenous intussusception and a gangrenous intestine under other circumstances. The method here described was adopted for the occasion and is applicable in cases of extensive gangrenous intussusceptions in which too much intestine is involved in the intussuscipiens to justify excision of the entire mass, including the intussuscipiens. I am of the opinion that radical excision for gangrenous intussusception will in the future be done more frequently and successfully than it has in the past, though, of course, a conservative compromise will be necessary in many cases. I believe the method described in this case is cleaner than any other method I have seen described for extensive gangrene, and I would certainly do the operation in a similar manner in another similar case.

RESECTION OF TEN FEET, TWO INCHES OF SMALL INTESTINE, WITH RECOVERY.

BY EDWARD STAEHLIN, M.D.,

OF NEWARK, N. J.

J. T., a man, aged forty-seven, married, native-born, fireman by occupation, a strong, healthy man actively engaged in his work, who never had been sick. The only bodily infirmity he has had was a large indirect reducible hernia on the right side. This he had had for thirty years, during which time it had always been reducible.

On the morning of February 25, 1906, while turning over in bed, he experienced a sharp pain in the region of his hernia, and for the first time since he had it was unable to reduce it. The pain grew rapidly worse (this was 7 A.M.) and vomiting set in at once. Assistance was summoned, but the hernia could not be reduced. The pain became excruciating and vomiting was continuous. He was sent to the City Hospital at 11 A.M. and operated upon at once.

The protrusion was as large as a good-sized head and very tense, and tympanitic on percussion. The pulse was fair, temperature subnormal, the facial expression very anxious and decidedly pinched. He vomited and retched continuously. On exposing the gut the coils brought immediately to view were gangrenous, and the underlying coils were highly congested and gangrenous in places here and there throughout their entire extent. The entire mesentery involved had turned a deep mahogany color; the veins were thrombosed, and the arteries had ceased to beat. The condition of affairs was evidently as follows: There was a tremendous hernia of the small intestine which had come down. This had always been readily replaced through the greatly enlarged ring, but on this particular morning, while in the act of turning over in bed, an additional knuckle of gut was forced into the ring in consequence of the increased intra-abdominal pressure prompted by the muscular exertion in the act of turning over, and so the ring was effectively occluded and caused strangulation.

The entire length of gut which contained gangrenous areas

was securely clamped off and removed. Then the mesentery was ligated and resected close up to its upper attachment. This latter was ligated by a series of interrupted chain ligatures of catgut. The ends of the gut were then approximated and reunited by end-to-end anastomosis; celluloid was used as suture material. Two layers of sutures were done, the first through-and-through and the second layer through muscular and serous coats (Lembert). The remnant of mesentery was then approximated and the gut was dropped into the abdominal cavity. Gauze drainage was used.

The patient rallied well and the dressing was changed for the first time one week after the operation. Three days later when the dressing was changed gas escaped through the wound; on the following day there was a fecal discharge. From this day on the wound was dressed daily and in nine days the fecal fistula had closed.

He was discharged cured in seven weeks. His convalescence was watched with a great deal of apprehension lest the stools should become permanently liquid and so cause gradual inanition. This was not the case, however, and within two months after his discharge from the hospital he resumed his duties as a fireman. He still wears a truss, as the attempt for radical cure was abandoned on account of the conditions encountered.

He eats and drinks as before and has regained his former weight.

The entire length of gut removed was ten feet two inches, and it was taken as nearly as could be made out from the middle of the small intestine.

FRACTURES OF THE OS CALCIS AND ASTRAGALUS.

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OF BOSTON, MASS.,

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AND

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OF BOSTON, MASS.

Assistant in Anatomy, Harvard Medical School.

We have been led to undertake this study, because during the last few years many cases have come to our notice in which a failure to accurately diagnose the condition has led to results certainly less good than might have been obtained by better directed methods. At the outset of the investigation we supposed these fractures to be uncommon, but this opinion we have been obliged to change and now incline to the view that they are more common than has been generally supposed.

Our deductions are based upon the study of 111 cases admitted to the Massachusetts Hospital during the last fifteen years. In many cases the notes are not sufficiently accurate to permit conclusions to be drawn upon many of the minor points, and we have confined ourselves in most instances to the discussion only of those cases in which we have personally studied the X-ray plates or been able to examine the patient a considerable time after the injury.

Etiology.—Age, occupation, and sex: As might be expected the occurrence of these fractures follows the rule common to all severe fractures, that they occur more frequently in those whose age and occupation expose them to external violence. Thus no fractures in this series occurred in children, very few in women, the vast majority in men in the prime of life.

Frequency: No method of estimating the frequency with

which any fracture occurs is wholly satisfactory, as the situation of the observer, the class of population with which he has to deal, and entirely accidental causes, influence the number very greatly. It may, however, be of interest to note that during the last eleven years there have been in the hospital 83 cases of fractures of astragalus and os calcis, 204 cases of Potts' fracture and 396 cases of fracture of the femur.

Method of Production: To decide by exactly what mechanism these fractures are produced, is a matter of more than ordinary difficulty, for the various factors entering into the question are many and it is practically impossible accurately to estimate the value which should be given to each. The problem differs materially from that in fractures of long bones or bones not situated in such immediate proximity to many complicated joints. It would obviously be important, were it possible, to know the exact position of the foot at the moment the force was applied. Thus, theoretically at least, the amount of extension, the presence of inversion or eversion, the condition in regard to tonicity of the various muscles acting upon the foot, and the strength of certain ligaments, must be known if we are to arrive at a correct estimate of these various factors. While much ingenuity has been expended in the attempt to give to these factors their correct importance, it does not seem to us, with the data at hand, possible to apportion their value with sufficient accuracy to yield valuable results. It is, however, entirely possible, and quite important, to note in general how these accidents occur.

Fractures of the Os Calcis: These fractures are in the great majority of cases true compression fractures, and are generally due to a fall from a height on to a hard substance, as the ground or the floor of a building. The bone is crushed between the astragalus above and the ground or floor beneath, the astragalus being protected from the direct force of the blow by its situation between the two malleoli, and probably also by the crescentic contour of its upper surface, which tends to distribute the force of the blow. Some of the observations upon this point by our Continental brethren are not without their

humorous aspect. One gentleman, for instance, gravely assures us that if a man falls from a height of fifteen or eighteen feet onto a stone floor, the os calcis will be broken, provided, always, that the floor does not give way. The bone may also be broken by direct violence, as in the case of one patient, whose heel was caught between the curb-stone and the wheel of a wagon; or by weights falling upon the foot so as to strike upon the side. These are not, however, common methods of production. In our series there are sixty-three cases in which the nature of the accident is described. Of these, fifty-nine were due to falls from a height, and four only were produced by direct violence.

Astragalus: As we have already suggested, the protected position of this bone makes it less likely to be broken by crushing strains, but it is nevertheless frequently fractured in this way. Thus Hamilton,[1] in ten cases, found that nine were due to falls from a height, and Gaupp,[2] in sixty-one cases, found that forty-five were produced in this way. In our series the method of production was known in thirty-five cases. Of these, twenty-one were due to falls from a height and fourteen to direct violence, (see Fig. 20). This appears to be a considerably larger proportion than that noted by most previous observers, but the series presented by Hamilton is too small to warrant accurate deductions, and our series is sufficiently limited, so that the proportion of three to two is likely to err considerably in either direction. It is important to note, however, that the proportion of the fractures of this bone due to direct violence is much greater than that of the os calcis.

Pathology.—Our knowledge of the pathology of these fractures must be derived largely from the study of X-ray plates, as the number of cases in which the accident is fatal—and it is possible to study the exact conditions at autopsy—is very limited and the position of the bones is such that little reliance can be placed upon inferences drawn from examination with the fingers. It is perhaps not too much to say that most of the errors occurring in diagnosis result from too much

dependence being placed upon methods of examination other than the X-ray. It would be an endless task to attempt to describe all the possible fractures of these bones, and we have not ourselves felt competent to decide, even from a careful study of an excellent series of X-ray pictures, the exact details of the fracture in many cases. Certain general types of fractures, however, can be distinguished, and we have made our classification rather with a view to the possibilities of treatment than following the lines of previous observers.

Os Calcis: We have been able to distinguish three general types of fracture of this bone—(1) That in which the fracture has been confined largely to that portion of the os calcis lying behind a vertical plane through the middle of the body of the astragalus. These we have described as heel fragments. They may be further subdivided into (*a*) cases with one large heel fragment (see Figs. 2, 3 and 4), (*b*) cases of small heel fragments which practically correspond to the avulsion fractures of other authors (see Fig. 6), and (*c*) cases showing cracks or fissures in the portion of the bone above noted, which, had the injury been more severe, would have resulted in the breakage of heel fragments (see Figs. 7 and 8). (2) That in which the force of the blow has been expended upon that portion of the os calcis lying beneath the astragalus, in front of above plane—in other words, roughly, the anterior half of the bone. These we have described as comminution of the anterior half, as in our series all the cases show comminution (see Figs. 10 and 11). (3) In this class we have placed those cases in which the whole os calcis is crushed and converted into what might be described as a bag of bones, the fragments being held together, apparently, only by the shreds of periosteum and by the surrounding soft parts. The bone is literally shattered. These cases we have described as completely comminuted (see Figs. 12 and 13).

In only nineteen cases have the X-ray plates been sufficiently perfect so that accurate deductions could be drawn. Of these, Class 1 (heel fragments) contains eight cases; Class 2 (the cases of the anterior comminution) contains five cases;

Class 3 (the completely comminuted cases) contains six. From this it appears that Class 1 is slightly more common than either of the other classes, but the difference is not sufficiently great to justify conclusions.

As fracture of the sustentaculum tali has been frequently mentioned by other observers, it would be improper to pass it without mention. It belongs, however, to the anatomical rather than to the clinical method of classification, and while it is by no means improbable that such fractures might take place even without other damage to the bone, we have seen no cases in which this has occurred as a distinct type. In many of the cases—notably, those in Class 3—there is undoubtedly fracture of this process, but as it is only an incident of the whole injury and not in itself important, we have not been inclined to give it prominence. Our study of the X-ray plates makes us doubtful whether we could distinguish such a fracture if it occurred, and to identify it by any other name is to depend upon mere guess work.

Astragalus: The classification of fractures of the astragalus is much more simple than those of the os calcis. The position of the bone is such that it has a protected part and an exposed part; the body being largely protected by its position between the malleoli, and the neck, exposed particularly to violence giving a twisting strain, or to crushing blows falling in front of the body.

1. Fractures of the Neck.—This is much the most common fracture of the astragalus (see Figs. 18, 19 and 20). Gaupp, in forty-nine cases, saw it eighteen times, and in our series it occurred in ten out of fifteen cases in which the plates were satisfactory. Of these cases, five were due to falls; five due to direct violence.

2. Fractures of the Body.—This fracture is due to a crushing force similar to that which results in fracture of the os calcis, sometimes occurring with the latter, and it is difficult to decide what factors influence its production. The variety of fractures is very considerable, varying from two large fragments to complete comminution of this portion of the bone.

It has not, however, seemed to us that a more minute classification was important from the point of view of treatment. In our series of fifteen cases it occurred five times, always from falls (see Figs. 21 and 22).

Os Trigonum[3]: No discussion of fractures of the astragalus is to-day complete without some reference to this curious little bone, which is sometimes attached to the astragalus as a process, on its posterior aspect, sometimes entirely detached, and joined only by a cartilaginous union, sometimes partially fused, showing that it had previously been detached. Its importance lies largely in the fact that when displaced upwards as a result of injury to the foot, it is frequently described, from an examination of the X-ray plates, as a fracture, and it is always wise to bear the fact of its occurrence in mind and not be misled by the appearance of an apparently isolated fragment just behind the posterior border of the astragalus (see Fig. 17).

Diagnosis.—An extended discussion of the methods of diagnosis in fractures of these bones would be out of place here, as they differ in no essentials from those applied to fractures elsewhere. We wish, however, particularly to draw attention to the fact that these methods have been so inaccurate as to prove conclusively that they are not to be depended upon. Thus, Ehret[4] in a series of forty-seven cases, found that only three had been correctly diagnosed immediately after the injury. In our series of sixty-six cases of fracture of the os calcis, a large majority of which came directly to the hospital and were under the care of a skilled staff with most modern methods at their command, seven cases were wrongly diagnosed and as a result wrongly treated. Of these seven cases, two were hospital cases and five had been under the care of other practitioners; three were regarded as sprained ankles, one as a Potts' fracture, one as a dislocation, two apparently as simple bruises of the foot. As will later appear, the results of the treatment of these fractures are so bad that no method which will lead to their more accurate treatment should be

neglected. The tenderness and swelling are such that even in the most skilled hands accurate diagnosis is entirely impossible except by means of the X-ray, and we believe that no case can be considered as having been properly diagnosed until a satisfactory X-ray plate has been examined.

In the case of the astragalus, in thirty-eight cases three were wrongly diagnosed—all of these by practitioners not connected with the staff. One was regarded as a contusion, one as a sprained ankle, one fell into the clutches of a "natural bone-setter," who failed to set the bone. All these cases were fractures of the neck, which theoretically should be easier to detect than fractures of the body of the astragalus or of the os calcis. The statement made above in regard to the use of the X-ray in fractures of the os calcis is equally true and its effect upon treatment is even more marked, as accurate diagnosis will enable the surgeon to decide exactly what condition he has to deal with and what measures must therefore be taken. This will be further discussed under "Treatment."

Prognosis.—We cannot better illustrate the probable outlook in these cases than by discussing the results which have actually been obtained in the cases under our observation. We have been much impressed by the fact that the majority of the results are not good as compared with most other fractures, and we have thought that in some cases, at least, somewhat better results might have been obtained by different methods of treatment.

The cases which we have used in this classification are only such as we have personally examined more than one year after the injury. Many of them were seen more than three years after injury, so that we believe we have obtained a fairly satisfactory view of the ultimate results. We have classified the results as "Good," "Fair," and "Bad," which terms we have defined as follows:

1. Good.—Those cases having a useful foot without pain, or at least without much pain. None of them are entirely

normal, and in the great majority there is marked limitation of lateral motion (see Figs. 4, 5 and 9). In our series at least, no case was seen with anything approaching a return to normal condition of the bones.

2. Fair.—Those cases in which the patient has been able to return to work and in which his earning capacity has been but slightly impaired, but in which pain, some disability, and the necessity for wearing pads, plates, or other form of apparatus, have been present (see Fig. 3).

3. Bad.—Those cases in which there is marked disability and the earning capacity has been distinctly diminished (see Fig. 16).

Os Calcis: We have been able to examine twenty-six cases in which the end result of the injury was known and the patient personally seen more than one year after injury.

These showed: Good result, 13, or 50 per cent.; fair result, 10, or 38 per cent.; bad result, 3, or 12 per cent.

Examining these cases more closely, with a view to determining what type of fracture gave the best result, the X-ray plates have been sufficiently satisfactory in twelve cases. Of these, seven were classified as "heel fragment" cases, and of these 5 were good, 1 fair, 1 bad.

Five cases were classified as "comminuted." Of these, none were good, 4 fair, 1 bad.

It seems, therefore, just to conclude that the cases classified as "heel fragment" cases show a better end result than the cases with much comminution.

Astragalus: We have been able to see and examine eight cases of fracture of the astragalus. These showed: Good result, 2, or 25 per cent.; bad result, 6, or 75 per cent.

From such a small series it did not seem possible to determine what type of fracture was the most favorable. It did, however, appear that cases with a fracture of the neck did not

always give bad results, and that the amount of displacement between the body and the neck was, as would be expected, the most important element in permanent disability. It is very obvious from the results that this fracture gives a result distinctly worse than fracture of the os calcis.

Duration of Disability.—Since, at the present time, many of these cases become the subjects of litigation, it is important to inquire in regard to the duration of disability.

Os Calcis: The duration of disability was known in twenty cases of fracture of the os calcis. Of these, 14 were disabled not in excess of six months; 1, from six months to a year; 3, from a year to a year and a-half; 2, from a year and a-half to two years. The average duration of disability was somewhat in excess of six months.

Astragalus: The duration of disability was known in nine cases of fracture of the astragalus. Of these, in 1 it was not in excess of six months; in 2 it lasted from six months to a year; in 2, from a year to a year and a-half; in 1, from a year and a-half to two years; in 3, over two years.

The average disability was about a year and a-half. From this it will be clearly seen that the duration of disability in fractures of the astragalus is much in excess of that in fractures of the os calcis, and the probable duration of disability will be an important factor in estimating the appropriate compensation for damage in these cases.

Other Factors Influencing Prognosis.—In examining these cases we have been struck by the frequency with which marked thickening is found in the region of the external malleolus and by the fact that it is the point to which many of them refer most of their pain. Thus, out of eighteen cases of fracture of the os calcis, in which our notes are complete on this point, we find that in twelve there was marked thickening in the region of the external malleolus (see Fig. 15), and in only three was the thickening marked beneath the internal malleolus. Gaupp ascribes this thickening to the forcing of fragments outward, because the foot is more or less

inverted at the time of the injury. It seems to us more reasonable to suppose it to be due to the anatomical arrangement of the bones, by which the force, transmitted directly downward, will be somewhat broken on the inner side by the anatomical position of the neck of the astragalus and its tendency to give, whereas, upon the outer side the force is exerted directly upon the body of the astragalus and transmitted to the os calcis. It may also be suggested that the lower position of the external malleolus and the smaller size of the depression on the outer side of the ankle make the fragments thus placed a greater source of obstruction to motion. In many cases the arrangement of the thickening is such as to suggest that the tip of the external malleolus was practically embedded in new-formed bone, and that there was an attempt at the formation of a false joint in this position, with accompanying pressure and pain. In one case, at least, removal of the overgrowth of bone in this position produced marked improvement in the symptoms and the foot was transformed from a bad to a good result (Fig. 16). We believe that more attention should be paid to this point and that more frequent resort to surgical intervention after the disability is fully developed will result in considerable improvement in many cases.

Compound Fractures.—As might be expected, the cases of compound fracture show a long period of disability. Infection is common, and complicated, as it is, by the proximity of many joints, makes it proper to classify this injury as a very serious one. In not a few reported cases amputation has ultimately been necessary and in most cases repeated operation only has resulted in cure.

Treatment.—Treatment may be divided into that applicable to fresh cases, and a discussion of what may be done to remedy the disability caused by old fractures which have either been improperly treated or in which serious disability has resulted in spite of the best of care.

Treatment of Fresh Cases.—The general principles of treatment do not essentially differ from those applicable to other fractures in this region. The foot should be elevated, and during the stage of acute swelling can be put up in a "pillow" splint or posterior wire splint in such a way that the bandages can be readily removed, the condition of the soft parts inspected, and ice-bags applied if necessary. Where the skin is threatened by a loose fragment, it must be carefully watched with a view to replacing or removing the fragment by operation before the vitality of the skin is too much lowered. After the swelling has considerably diminished—generally at the end of a week or ten days—an attempt may be made to improve the position if loose fragments are present. In impacted cases little but damage is likely to be done by manipulation, unless undertaken as the result of indications clearly shown in the X-ray plate, and by methods to be discussed in detail later. Except for the retention in position of loose fragments, and after operative interference, there is little necessity for immobilization in these cases, and the slavish adherence to this principle of the treatment of fractures is likely to increase rather than diminish the disability. In impacted cases, early massage and passive motion are to be strongly advised, though of course care must be taken to see that loosely-impacted fragments are not disturbed. The most common and serious error in treatment is to allow the patient to bear his weight upon the foot too early. We are entirely in accord with the opinion expressed by Nasse and Borchardt [5] that these cases should bear no weight on the foot for at least sixty days. It is abundantly evident that the amount of callus in many cases is excessive and is an important cause of disability, and it seems reasonable to suppose that the amount of callus will be considerably increased by early use of the foot. On the other hand, massage and passive motion, by tending to preserve free movement in all the joints and prevent unnecessary adhesions, will have a marked effect in diminishing the disability. After the union is firm—that is, after a lapse of about sixty days—the use of the Zander apparatus as a supplement to

passive motion is of undoubted benefit. There remain, however, a considerable number of special considerations, based upon a thorough understanding of the nature of the fracture, which will influence the surgeon in the treatment to be adopted, and which must be considered in detail.

FRACTURES OF THE ASTRAGALUS.

Fractures of the neck.—1. Cases in which the anterior fragment, consisting generally of the head and neck, is more or less dislocated and threatens the skin, require prompt treatment. It is occasionally possible to reduce the dislocated fragment and free the skin from dangerous pressure. Where this can be done it may be satisfactory, but in many cases the reduction will be only partial, sufficient, indeed, to relieve the immediate danger of the skin, but entirely insufficient to lead to a good after-result. Where reduction is possible they come into the class to be considered in the next heading. Where reduction cannot be achieved, or where the vitality of the skin has been seriously compromised, immediate operation is to be advised. This should consist in a free, curved incision over the front and outer side of the ankle joint, which will give good access to the fragments. The annular ligament should be divided and tendons retracted to an extent sufficient to give thoroughly good access. If the anterior fragment is sufficiently shattered and torn from its attachments to seriously compromise its vitality, a better result will probably be obtained by its complete removal than by an attempt to restore it to an approximately normal position. If, on the other hand, the principal fragment is large and its blood-supply probably good, it may be replaced in its proper position and held either by suture or wiring. The number of cases in which replacement with suture has been attempted is too small to warrant conclusions, and, though it is an ideal method of treatment, it is proper to admit that excellent results are obtained after complete removal of the head and neck of the bone, and that the danger of bone necrosis, with or without infection, is much less.

It is unnecessary to add that such an operation must be attempted only under the very best conditions and with the strictest attention to asepsis.

2. *Fractures of the Neck with Rotation of the Posterior Fragment.*—This class is quite similar to the one just considered, except that as the skin is not threatened there is no indication for immediate intervention, and operation should not be undertaken until the swelling has subsided and the tissues are in a better condition. Reference to the illustrations will show, better than any description, the reasons for operation in these cases (Fig. 19). The results without operation are nearly uniformly bad. Great limitation of the ankle joint is the rule and is not likely to be exceeded by that resulting from operative failure. In short, it is hardly probable that the ultimate condition will be made worse, and there is the best reason for supposing that it will be greatly improved.

The end to be sought by operation is the restoration of the fragments to their previous position. The difficulty lies in the rather insufficient exposure by any incision at our command, and the difficulty of rotating the body or posterior fragment into a normal position and then holding it in contact with the anterior fragment. If this can be done in a reasonably satisfactory way it is to be preferred to the alternative of removing the anterior fragment, but the latter procedure has given excellent results. The choice between these two operations can probably not be made until the joint is freely opened and the position and motility of the parts have been accurately determined. The importance of operation can be determined by a critical examination of the X-ray plate, but not the exact operation which will give the best results.

3. *Fractures of the Body.*—Fractures of the body of the astragalus are commonly impacted and frequently complicated by impaction of the underlying portion of the os calcis (Fig. 22). Though the ultimate result is likely to be bad, and much loss of motion at the ankle joint frequently results, it does not

appear that operation is likely to improve the condition. In some cases, however, the fracture is not impacted, or, at least, is partially impacted, being complicated by loose fragments, particularly from the anterior portion of the body. These fragments are particularly likely to become fixed in such a position as to prevent dorsal flexion, and when such fragments exist their removal is indicated. It is, however, by no means easy to determine the looseness of such fragments, or, indeed, to definitely state their origin. In one of our cases a fragment lying in front of the body of the astragalus was removed, and was thought to have come from that bone, but a study of plates leaves us in considerable doubt as to its origin.

OS CALCIS.

1. *Small Loose Heel Fragments (the Avulsion Fracture).*—These cases, which may be typified by Fig. 6, are best treated by operation. If left to nature, the convalescence is slow and a troublesome prominence over the heel is practically certain to result. The fragment is readily exposed by a curved incision and may be held in position by a nail or by suture or wiring, as suggested by Eisendrath.[6] The simplicity of the operation and the practical certainty of a good result, if skilfully carried out, seem to make the indication clear.

Large Heel Fragments.—These cases open an interesting field for discussion of possible benefit which may result from active treatment. When treated expectantly the results are frequently far from satisfactory. The upward displacement of the heel fragment generally results in troublesome "flat foot," and it is certainly possible that the condition may be improved by an attempt to improve the position. Carless[7] has suggested the possibility of pulling down the fragment into its proper position, or even over-correcting the deformity after division of the tendo Achillis. We have ourselves in one case done this without knowledge of previous work, and the result has been sufficiently favorable to encourage us to make a

further attempt in this direction. In this instance, after subcutaneous tenotomy of the tendo Achillis, a large posterior fragment, which was partially impacted, was loosened, though with some difficulty, and its position apparently improved. The ultimate result has been considerably better than in most of the similar cases which we have seen. The difficulty in improving the position in this case came from inability to get a firm grip upon the heel fragment. This could be readily done by drilling two small holes on the sides of the heel fragment and inserting powerful hooks, such as those used by Porter,[8] in elevating the head of the bone after fracture and dislocation of the head of the humerus. With this addition to the technic there seems to be no doubt that the fragment could be broken loose from its impaction and placed in an improved position. It would probably be wise to over-correct the deformity and make the arch of exaggerated height on account of the tendency of these fragments to work upward as the swelling goes down beneath the plaster. A snugly-fitting plaster-of-paris dressing seems the most appropriate method of retaining position in these cases. While our experience is entirely too limited to warrant the assertion that such a method is to be unhesitatingly advised, we feel that further research in this direction is much to be desired.

2. *Fissures—Comminution of the Anterior Half—Complete Comminution.*—In the treatment of fresh cases of these varieties it does not appear that anything but expectant treatment is justifiable. In case of fissure a good result is generally to be had by this method. In comminutions of the anterior half the resulting disability comes from flattening of the arch and from the lateral displacement of fragments, particularly to the outer side, which interfere with the lateral motions of the foot and cause pain. It is possible to improve somewhat the flattening of the arch by padding under a plaster bandage, and this should always be attempted. In the early stages it is impossible to estimate how much trouble the lateral fragments will cause, and active intervention is therefore best postponed

until union has taken place and any indication for interference can be more accurately mapped out. In the case of complete comminution the same reasons make it unwise to interfere, except for the relief of resulting disability.

Old Cases.—The surgeon is frequently called upon to decide what can be done to improve the results of old fractures, either of the astragalus or os calcis, which have either been wrongly diagnosed, improperly treated—particularly by too early use—or which have followed the most conscientious treatment. The chief complaints are of limitation of motion, pain, or faulty positions of the foot, with displacement of the normal weight-bearing line. Many of these cases can be improved, and we are inclined to feel that the tendency has been to over-conservatism, and that greater willingness to attempt operative relief will be followed by good results.

Old Fractures of the Astragalus.—In these cases there are two prominent indications for operation:

(1) Limitation of motion: This frequently follows fracture of the neck of the astragalus with faulty union, as shown in Fig. 20. Motion is likely to be very much limited, and may be practically nil. The two operations to be considered are partial, or complete, astragalectomy. In the partial operation only the head and neck of the bone are removed, and this is particularly applicable to cases of faulty union due to rotation of the posterior fragment. The resulting improvement in motion in these cases has been very encouraging. Where the disability is great, and removal of the anterior fragment does not relieve the condition (a situation particularly likely to occur where the body of the bone has been broken), complete astragalectomy should be seriously considered. The possibility of a worse result is not large and very great improvement has followed in some of the cases in which this has been done.

2. Cases of Valgus or Varus Deformity: Cases of fracture of the astragalus are particularly liable to the worst varieties of

pronated " flat foot." This is well illustrated by the case shown in Fig. 23. In this case, as in other similar ones, the amount of motion at the ankle joint was sufficiently good to make it improbable that it could be improved by operation. On the other hand, very great disability resulted from the position of the foot, and operation was indicated for the same reasons that it is to be advised in severe cases of rigid " flat foot." The operation most applicable is the osteotomy of Trendelenburg,[9] in which the tibia is divided with an osteotome from side to side just above its articular surface, the chisel being manipulated so as to leave a V-shaped gap. The fibula is then divided at a similar level and the whole foot carried inward until the weight-bearing line is normal. The operation has been frequently done by the orthopedic surgeons for " flat foot " and with excellent results, but it is important not to over-correct the deformity as, there is little or no tendency of the bones to return to their former position, and it is entirely possible to convert a valgus into a varus foot by over-correction. Extended discussion of this point does not seem necessary, as the problem is essentially that of " flat foot."

Fractures of the Os Calcis.—These fractures do not present an attractive field for late operative interference. In those cases, however, in which there is excessive callus formation below the external malleolus, resulting in a painful foot, considerable relief may be expected. Whether this pain is due to pressure upon nerve filaments or simply to pressure of the lower end of the fibula against the new-formed bone, we are unable to decide, but the indication for the removal of such offending masses of bone seems to us clear, though it cannot be expected to influence, to any great extent, the motions of the foot. In many of these cases, however, pain rather than limitation of motion is the cause of disability, and where this is the case operation is practically certain to result in improvement.

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[7] Carless. Practitioner, Lond., '02, lxix, 651.
[8] Porter. Trans. Am. Surg. Ass., 1894, Vol. xii. p. 287.
[9] Trendelenburg. Arch. f. klin. Chir., Vol. xxxix, 1889.

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FIG. 1.—Fracture of the os calcis. This illustration shows well the amount of local swelling, the extent to which it is confined to the foot, and the lack of obvious deformity.

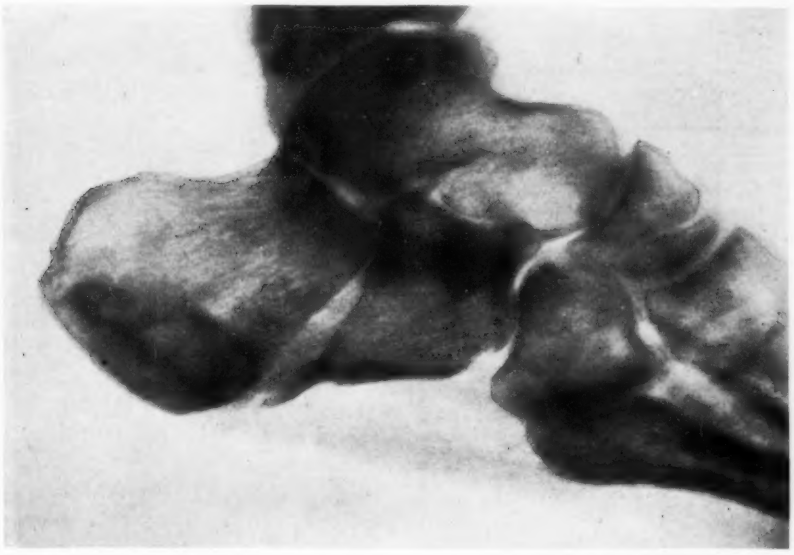

FIG. 2.—Fracture of the os calcis. Man, 40 years, fell ten feet, striking squarely upon both heels, on the ground.

X-ray shows fracture of the os calcis of the large heel fragment type.

This is a favorable case for tenotomy of the tendo Achillis and reduction of the posterior fragment, with restoration of the arch.

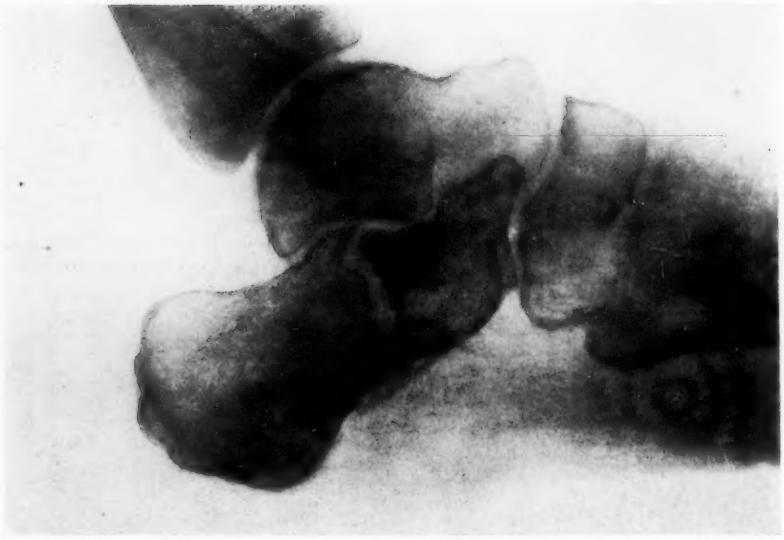

FIG. 3.—Fracture of the os calcis. This patient, a man, fell 15 feet on to frozen ground, striking upon both feet, in February, 1899. Right heel showed abnormal mobility and crepitus over the os calcis. X-ray shows comminuted fracture with large heel fragment. Treated with pillow splint; later, plaster of Paris bandage.

May, 1895. Has some pain through ankle joint. Always wears an insole. Is considerably hindered about his work. Examination, right foot: Considerable bony overgrowth beneath external malleolus. Motions: No flexion beyond right angle. No adduction. Very little abduction. Fair extension. Good position. Longitudinal arch, fair. Classed as fair result.

FIG. 4.—Fracture of the os calcis. Man, 26, fell from moving car, striking left foot against tie. In May, 1899, X-ray shows fracture of os calcis, large heel fragment type, with tendency of posterior fragment to be drawn upward. Plaster of Paris bandage.

June, 1905.—Reports returned to work after three and a half months. Very little trouble at any time. Foot becomes tired after long day's work. Present condition, slight fulness beneath external malleolus. Extension good. Flexion slightly limited. Very little lateral motion. No "flat foot." Classified as good result.

FIG. 5.—Fracture of the os calcis. Shows same foot as Fig. 4, six years after injury. Note great thickening of central portion of os calcis with fusion of astragalo-calcaneal joint.

FIG. 6.—Fracture of the os calcis. A beautiful example of small heel fragment type of fracture—the avulsion fracture of other authors.

Fracture caused by slipping while getting on a street car, apparently by sudden contraction of muscles of calf. Operation refused. Result unknown.

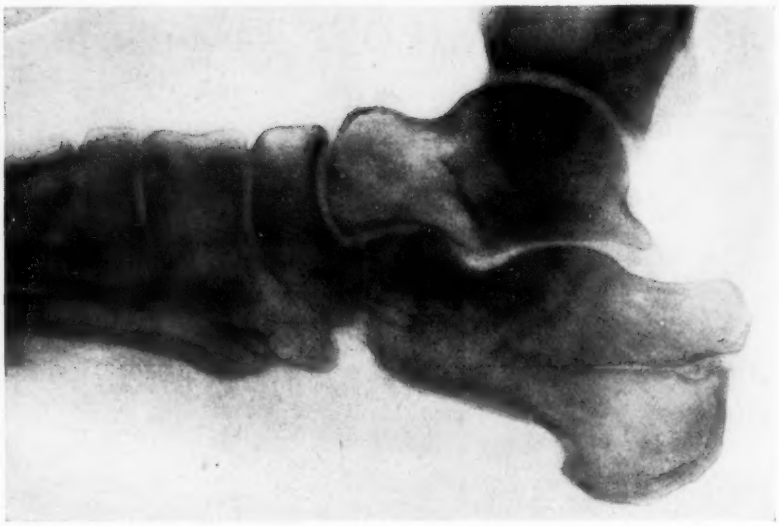

FIG. 7.—Fracture of the os calcis (left). Man, 44, fell ten feet to the ground, striking on both feet.

November, 1899. X-ray shows fracture of both ossa calcis of fissure type. Treated, plaster of Paris bandage.

May, 1905. Reports returned to work after six months. At first considerable pain in walking; now only in bad weather. Some soreness under instep, troublesome when climbing ladder. Examination of left foot showed practically no adduction or abduction. Flexion and extension good. Foot very flat and slightly pronated. Classified as fair result.

FIG. 8.—Fracture of the os calcis. X-ray shows right foot of patient whose left foot is illustrated in Fig. 7. Examination, May, 1905, showed some irregular thickening in front and below malleoli. All motions free. Considerable "flat foot." Weight-bearing line normal.

FIG. 9.—Fracture of the os calcis. Shows condition of right foot of patient described under Fig. 7, six years after injury. Note practical return to normal. Classified as good result.

FIG. 10.—Fracture of the os calcis. Shows type of fracture described as comminution of anterior half of os calcis. Result unknown.

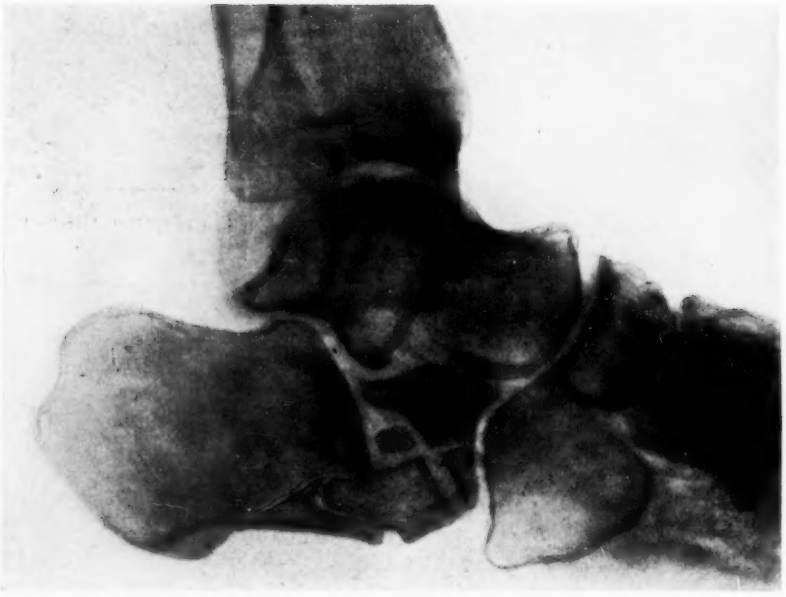

FIG. 11.—Fracture of the os calcis. Shows another type of comminuted fracture of the anterior half of the os calcis. Note great flattening of longitudinal arch. Result unknown.

FIG. 12.—Fracture of the os calcis (right).

FIG. 13.—Fracture of os calcis (left). Figs. 12 and 13 show the injury resulting to a man of 26 who fell thirty feet to the ground, striking upon both feet. On the right side the injury was compound. They represent the worst type of comminuted fracture of the os calcis. Classified as "completely comminuted;" injury too recent to show result.

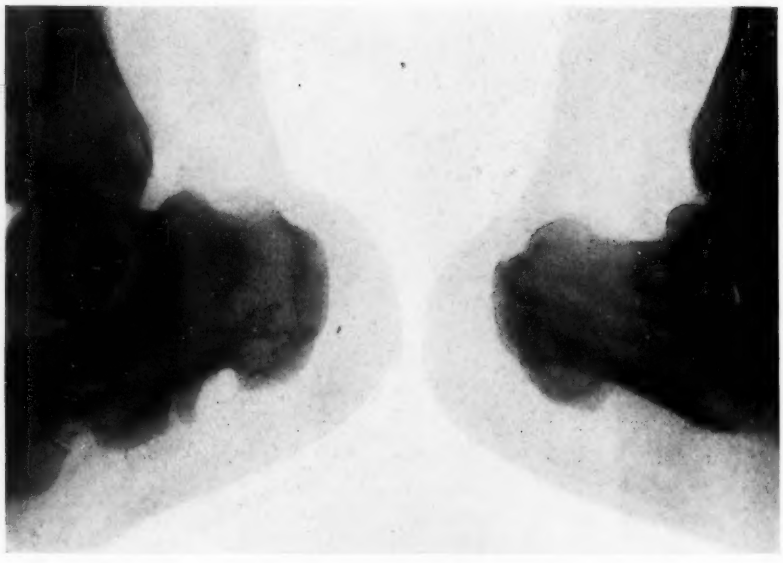

FIG. 14.—Fracture of both ossa calcis (lateral view).

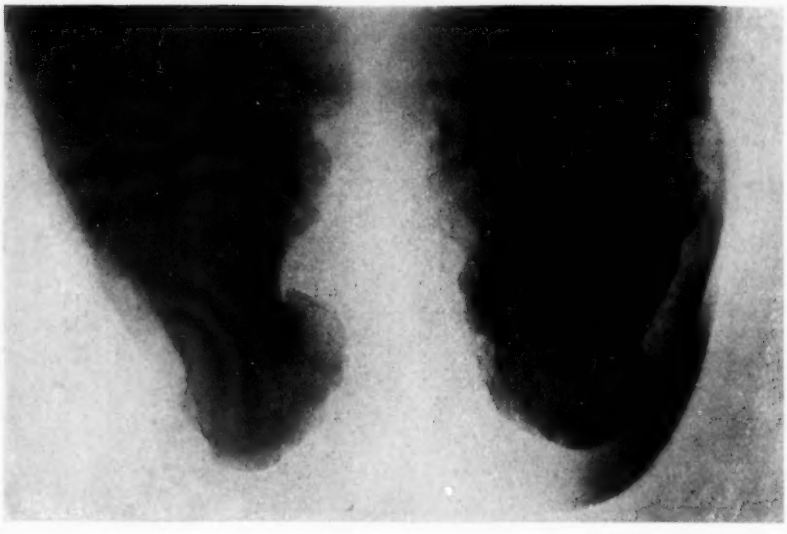

FIG. 15.—Fracture of ossa calcis. (Seen from above downward.) Figs. 14 and 15 show the condition six years after injury from fall of twenty feet on to concrete floor. In May, 1905, left foot shows much thickening below external malleolus. Longitudinal arch obliterated. Rigid pronated foot. Bad result. Right foot: Marked thickening to outer side of tendo Achillis. All motions good. Very little "flat foot." Good result.

FIG. 16. – Fracture of os calcis. The astragalus is here driven down into os calcis, lowering ankle joint. Eight months after injury: painful foot, much thickening under external malleolus, no lateral motion, limited flexion and extension. Bad result. Operation by Dr. Goldthwaite. Removal of bony overgrowth beneath external malleolus. Now useful foot.

FIG. 17.—Os trigonum. In cases of injury this is frequently mistaken for a chip from the astragalus.

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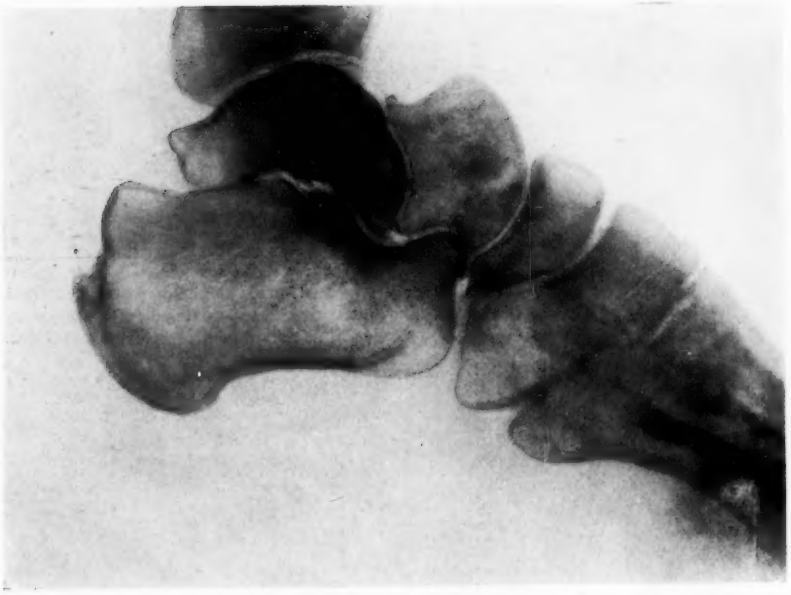

FIG. 18.—Fracture of the astragalus. Patient fell ten feet to ground, September, 1900. "Sprained ankle." X-ray, fracture of neck of right astragalus.

March, 1901. Bad result. Useless foot. Partial ankylosis. Partial astragalectomy, Dr. Brooks.

May, 1905. Foot slightly inverted, longitudinal arch raised, no lateral motion, no flexion, 10 degrees of extension. Painful foot. Bad result.

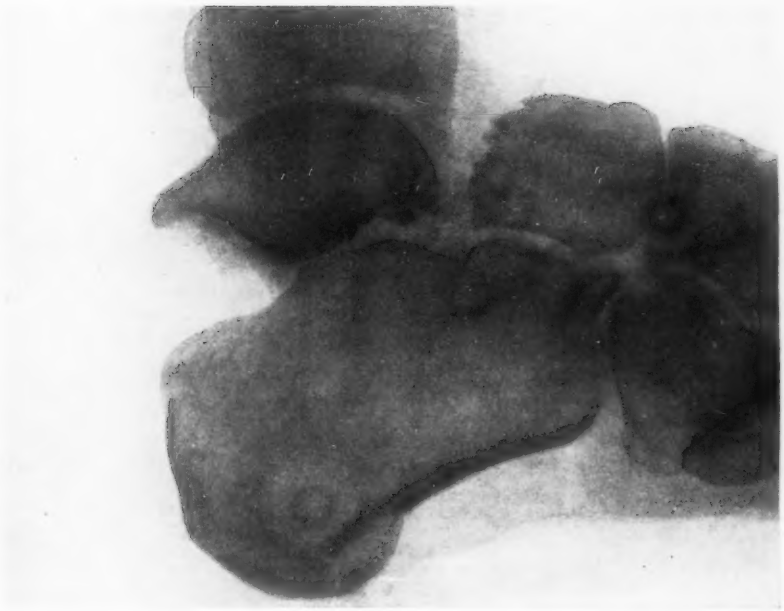

FIG. 19.—Fracture of astragalus. Fracture due to direct violence, from heavy bar falling on foot. May, 1904. Plaster of Paris bandage.

July 4. Trendelenburg osteotomy, Carney Hospital.

May, 1905. Painful foot. Forward displacement of foot on leg. Exaggerated longitudinal arch. Deformity not wholly corrected by operation. Marked inversion. Flexion good. Extension limited. Lateral motions limited. Bad result.

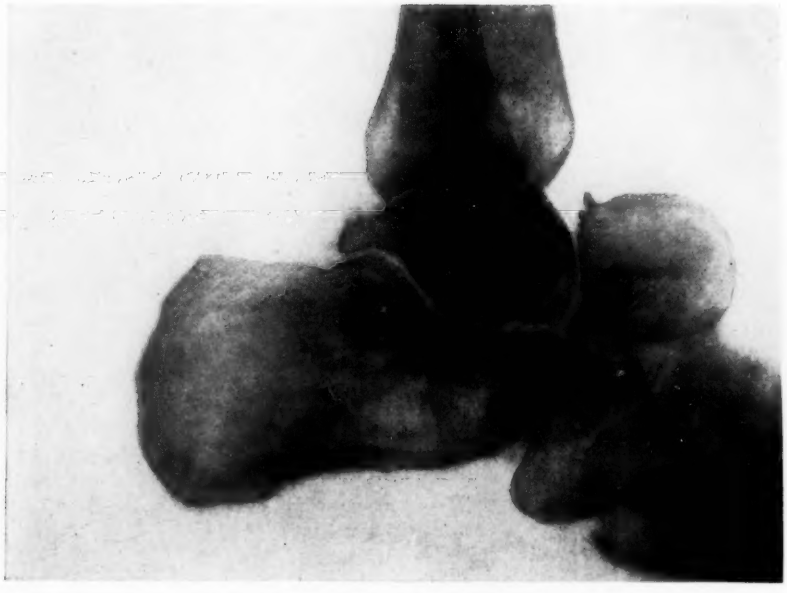

FIG. 20.—Fracture of astragalus. Foot run over by heavy team, February, 1902. Treated by natural bone setter. X-ray shows fracture of neck of astragalus. Operation advised and refused.

September, 1905. Painful foot. Much inversion, large bony fragment on dorsum (head of astragalus). Flexion fair. Extension poor. No lateral motion. Foot very flat. Bad result.

FIG. 21.—Fracture of astragalus. X-ray shows impaction of astragalus, especially in central portion, with lowering of ankle joint.

FIG. 22.—Fracture of astragalus. X-ray of right foot of patient shown in Figs. 23 and 24; impacted fracture of astragalus with lowering of ankle joint. Marked eversion.

FIG. 23.—Fracture of astragalus. Note marked eversion with displacement of weight-bearing line, showing indications for Trendelenburg osteotomy.

FIG. 24.—Same patient after osteotomy. Weight-bearing line partially restored. Foot converted from a poor to a good result. Now walks without discomfort or limp.

OLD FRACTURE OF THE TARSUS.

WITH A REPORT OF SEVENTEEN CASES.*

BY LEONARD W. ELY, M.D.,

OF NEW YORK.

In many cases of fracture of the astragalus or of the calcaneum the nature of the lesion is apparently not recognized at the time of its occurrence. Many of the patients are treated for sprain or contusion, or for fracture of the malleoli. Later their condition is often thought to be due to rheumatism.

REVIEW OF CASES OF FRACTURE OF THE CALCANEUM AND OF THE ASTRAGALUS.

Hippocrates described tear fracture of the calcaneum, and said that, when improperly treated, it often resulted in gangrene. Theodoricus, in 1546, and others following him, denied that the calcaneum was ever fractured: "Calcaneus non fragitur, quia os durum est et protectum ligamentis." "Nullo pacto calcis accidit fractura." Norris, in 1839, published the results of an autopsy on a patient who had fractured the anterior processes of both his calcanea by jumping in delirium from a third story window. Malgaigne, however, seems to have been the first to describe accurately this form of fracture by crushing force, giving it the name of "fracture par écrasement." Abel, reporting in 1878 three cases of fracture of the sustentaculum tali by direct violence, was surprised to find that he was almost a pioneer in the subject. Fractures of the anterior part of the bone are hidden from sight and from touch. This, he thinks, is the reason why they have for centuries passed unnoticed, while tear fractures of the posterior part have been recognized.

*Read at the annual meeting of the American Orthopædic Association, Toronto, August 21, 1906.

Since 1878 many cases of fracture of the astragalus and of the calcaneum have been reported, so many, indeed, that, unlike Abel, one is surprised at the great number of workers in the field. A study of the views of various writers lets in the light on what has been an obscure subject, and seems to point the way to a more successful treatment of these injuries.

Norris[1] reports a case of a man of thirty-five, who jumped from a window while drunk. Gangrene followed, and death. The autopsy revealed "fracture of the calcaneum in two places in its anterior part." There was no displacement. The author says that it was remarkable that the most certain diagnostic sign of this accident, the drawing up of the posterior fragment by the tendo Achillis, was absent.

Abel[2] appears to have been the first to recognize the importance and frequency of crush fractures of the calcaneum, and reports three cases of fracture of the sustentaculum tali, one being compound. This last case went to autopsy. Abel gives three symptoms as characteristic: First, broadening of the heel, Second, flattening of the foot and sinking of the malleoli, especially of the inner. This is due to the fact that the breaking off of the sustentaculum tali deprives the foot of its support on the inner side. Third, immediate pain and disability. Usually the disability is so great that the patient is unable to walk a step. If in an ordinary crush fracture the fragments are much impacted, the immediate disability is not so great. The author says that most of these fractures are treated for fracture of the leg bones, or for sprains.

Bailey's[3] case of fracture of the calcaneum is more or less doubtful. The patient, a farmer of forty years, had his foot caught between the table of a threshing machine and a wagon. From the description of the case one suspects fracture of the astragalus. The treatment consisted of rest on a pillow, with no splint. One year after the injury motion was limited at the ankle.

Goyder's[4] case was a compound comminuted fracture of the astragalus, with protrusion of the external malleolus. The foot was in inversion. Through the wound the author removed the astragalus, which had been broken into numerous fragments. The foot was put up in splints and the patient recovered with a movable ankle and a useful foot. Four and one-half years afterward the foot was shorter and narrower than the other. The patient could not bear his whole weight upon the front part of it, and, in walking, planted it squarely on the ground.

Bell[5] reports two cases of compound fracture of the calcaneum both caused by a fall on the feet. Nothing is said as to the amount of resulting disability, nor of the symptoms. In one case, "the bone was completely pulverized."

Van Buren[6] presented a specimen of a calcaneum which had been excised for caries following a comminuted fracture of the anterior portion,

several weeks before. The patient had been blown up by a blast, and landed squarely on his feet when he descended. Several months later the patient was about on crutches. This was the last note on the case.

Stimson[7] showed a specimen of an old fracture of the calcaneum. The injury had taken place eight years before, probably as the result of muscular action, and the bone had united in a bad position.

Whitman[8] reports a case of a double fracture of the calcaneum, compound on the right side, which was caused by a fall of eighteen feet. Death followed on the twelfth day from pulmonary embolism. The autopsy showed the following: "Fracture of inner aspect of right os calcis immediately below the articulation with the astragalus" (*sustentaculum tali* ?). Left side, "Os calcis . . . completely smashed. The superior surface . . . firmly impacted into the surface to which the tendo Achillis is attached. This portion of the bone was also fractured in various directions. . . . The remainder of the bone was broken into several fragments."

Bishop[9] published a case of a painter, thirty-four years old, who jumped from a ladder to the ground as the ladder slipped, a distance of thirty-six feet, and fractured his astragalus, external malleolus and cuboid. The foot was in inversion, and seemed shortened on its inner border. Part of the astragalus was dislocated on the outer side of the dorsum of the foot. The deformity was reduced under chloroform. On the eighteenteenth day the patient died of pneumonia. The autopsy showed the following: "The astragalus was divided into two main portions by a fracture which passed obliquely backwards and inwards, and from above downwards and forwards, along the line of the interosseous ligament, which was utterly destroyed." Part of the external lateral ligament had been torn, as well as some of the other ligaments of the foot.

Humphry's[10] patient was a boy of sixteen years, who fell sixteen feet on his left foot, and fractured his astragalus. A portion of the astragalus was dislocated and could be felt beneath the skin "on the left side of the dorsum." This was reduced under chloroform with difficulty and the foot was put up in splints. After two weeks the dislocation gradually returned and caused a small slough of the skin. Chloroform was again administered, the wound was enlarged, and the displaced fragment was removed. The fragment consisted of one-half of the astragalus which had been separated by a longitudinal fracture transversing the middle of the bone. Humphry does not say what was the end result.

Gussenbauer[11] reported a tear fracture of the calcaneum. He says that fractures from this cause are very rare. He nailed the fragment on to the body of the bone, and secured a good result.

Stimson[12] in 1888 gave the results of autopsy on a case of fracture of the os calcis and scaphoid. The patient was an adult male of thirty years who jumped in delirium tremens from a height of thirty feet.

Gilchreest[13] in the same year, reported two cases, one of fracture of the calcaneum from crushing between freight cars, one of fracture of the internal cuneiform. Both fractures were compound and were operated upon with good results.

Beeson[14] described three cases of compound fracture of the astragalus, two caused by a fall on the feet, one by a blow from a mass of iron. In all three the bone was broken into a number of pieces. Beeson removed the fragments and treated the wound by drainage. The first two cases ended in amputation. The third was under treatment at the time the report was made, but looked as if it would end in the same way.

Reed[15] gives the history of four cases of fracture of the astragalus with displaced fragments, which were treated conservatively. In three of the cases the results were bad, in one, good. In all, the injury had been produced by a fall on the foot.

Betts[16] showed a photograph of a calcaneum which he had removed from a painter. The patient had fallen about fifteen feet and landed on his feet on a stone sidewalk. He was treated for ten days under a diagnosis of sprained ankle. At the end of that time, when Betts first saw him, the foot had become infected. Final amputation was done to save the patient's life. Although the photograph is not very distinct, the case would appear from the author's description to be an impacted fracture.

Bähr[17] described ten cases of compression fracture of the calcaneum, all with the same cause, a fall from a height. The diagnosis, of course, was without the X-ray. Bähr says that the characteristic symptoms of recent fracture are (1) swelling under the ankle; (2) sensitiveness over the calcaneum; (3) restriction of motion at mid-tarsal joint; (4) great pain on walking, usually located under the external malleolus and anterior to it; (5) slow recovery. The motions of flexion and extension at the ankle are free, but supination and pronation, and abduction and adduction are painful and restricted. The foot may or may not be flattened; the calcaneum may or may not be thickened and the malleoli sunk, depending upon the amount of crushing. The author considers that the fractures of the sustentaculum tali reported by Abel are rarities. The part of bone broken depends upon the position that the foot is in. Bähr advocates, in closed fractures, plaster of Paris left on for a long time. He thinks walking should not be allowed for two months. It is a mistake to put the weight of the body on the crushed, soft bone. Afterwards, massage and active and passive motion may be tried. All stiff parts are useless and painful. Bähr thinks the flat foot is of little moment. The pain is due to the weight of the body upon the distorted bone, often not fully hardened, and is especially severe where a sprain has been diagnosed, and the patient urged to walk early. Prognosis as to complete recovery is bad. Bähr reaches three conclusions: First, fractures of the calcaneum are more frequent than has been thought. Second, they are usually unrecognized and are treated as sprains, fractures of the malleoli, etc. Third, they usually cause a prolonged disability, often of a severe grade.

Bähr [18] also reported a case of old fracture of the right calcaneum. Operation was done on account of a painful swelling in the heel which was diagnosed as a bunion. A piece of bone was chiselled off, with good results.

Jones[19] described an old fracture of the astragalus and calcaneum

in a patient who had fallen from a height of thirty feet, landing on his feet. The injury was followed by immediate pain. The diagnosis had been sprain of the ankle.

Ehret[20] in a paper published in 1896, states that of the 2016 patients treated at his institute, 47, or 2¼ per cent., had fracture of the calcaneum. Of these 47 only three came with the correct diagnosis. Thirty were of the left foot, thirteen of the right, and four of both. When the right alone was broken, the injury was distinctly of that foot. When the fall was upon both feet, the right was never broken alone, but the left was broken, or both. The stubbornness of the symptoms is marked. Only five patients were discharged completely well, and these were young. The cause is a direct blow or a fall on the feet, usually the latter. The fracture is always caused by an involuntary jump or fall, never when the patient jumps down naturally, for then he probably catches a large part of his weight on the front of his sole. The fall was always from a height, never a fall over on the level. There is no relation between the height of fall and the intensity of the fracture. Ehret has never seen a pure tear fracture, though he thinks the pulling of the muscles, fasciæ, and ligaments, plays a strong part in the crush fractures. He divides all fractures into those of the body and those of the processes. Immediate disability is not invariable. Dorsal and plantar flexion may not be limited. Abduction and adduction, and pronation and supination almost always are limited, because these motions take place between the calcaneum and the astragalus, scaphoid, and cuboid. The gait is characteristic, the foot being held immovable. The patient walks always on the same part of the sole. Ehret did not notice that the patient walks on inner border, but thinks he often walks on outer. The swelling is mostly about ankles and dorsum. There is thickening about the heels and filling in at the sides of the tendo Achillis. The author lays special weight on palpation. The outer side of the bone suffers most of the crushing, because the foot on the inner side can give way, whereas on the outer side it is rigid. When the body is weighted the inner ankle sinks (Sourier and Abel). Hence after fracture the external malleolus is nearer the ground. If both sink, the outer sinks more. The foot is always flattened because one of the most important stones of the arch is injured, and yet it is supinated. More than one-half of the author's patients were flat-footed before the injury. Foot clonus is present in about one-half of the cases. Calf cramps are frequent at night, and atrophy of the calf takes place. The diagnosis is made on five points: First, cause: usually fall on sole. Second: restriction of abduction and adduction, with peculiar gait. Third: change in the contour of the heel. Fourth: broadening of the heel. Fifth: flattening of the foot. The patient must not be permitted to walk too soon, for fear of injuring the bone further. Massage, electricity, baths, gymnastics, and shoes are recommended. The restriction of supination and pronation causes most of the resulting disability. By operation any loose pieces of bone can be removed, as also the retro-Achilles bursa.

Joy[21] reported a tear fracture of the calcaneum plus comminution,

received by an intentional fall on the feet. Open operation with tenotomy was performed, but nothing is stated as to the end result.

Golebiewski[22] described a case of fracture of the scaphoid, astragalus, and calcaneum, caused by the attempt of a hod-carrier to go up a ladder in his bare feet with a heavy weight on his shoulder. In this case the diagnosis was probably wrong, as no fracture of the calcaneum appears in the skiagram. Palliative treatment attained a fair result.

Neuschäfer[23] published a case of pure tear fracture of a large piece of the calcaneum. Tenotomy did not avail to reduce the dislocated fragment. An incision was then made over the heel, and the fragment was sewn in place. The foot was put up in plaster, in strong equinus, and union was uneventful. Three and one-half months later the patient walked without a stick.

Vollbrecht[24] reported two cases of fracture of the astragalus. The patients were adult males. One sustained his injury by a fall from a horse; the other by a kick from a horse. One had been diagnosed sprain, and the other contusion.

Carless and Mayon[25] find that many of these cases of fracture of the calcaneum do badly if left to themselves. The resulting pain is due to depression of the astragalus and to formation of a large mass of callus under the calcaneum. Treatment is "somewhat unsatisfactory." In the early stages evaporating lotions are recommended. If, after swelling has subsided, the foot is in a bad posture it should be twisted back under an anæsthetic, and plaster of Paris should be applied. In an old standing case with much deformity and pain a wedge of bone may be removed, or the head of the astragalus may be excised, or even the entire astragalus.

Raven[36] reported a case of fracture of the astragalus and possibly also of the calcaneum (compare with Urban's[35] case). The patient was a male, aged seventeen, a waiter, who had fallen ten feet, landing on his left heel. Great swelling of the left foot and ankle were present. The foot was displaced inward and was inverted. There was crepitus below the internal malleolus, and a small bony movable mass could be felt. In a few hours all physical signs were obscured by the swelling. After a week's rest the deformity was partly reduced under anæsthetic, and plaster of Paris was applied. Eight weeks later the patient had a fair amount of motion and could walk fairly well. The foot still remained much thickened.

Vegas[27] published a case of fracture of the astragalus in a boy of twelve who was thrown from a horse, and had been in plaster of Paris for forty days before Vegas saw him. The foot was inverted, and motion at the ankle was restricted. Excision of the astragalus gave a good result. The writer maintained that these fractures were rare.

Bennett[28] describes a case of fracture of the astragalus, which he thinks was probably caused by a blow. The specimen was obtained from the dissecting room and was without history. There was a single line of fracture without displacement, which had united.

Villard[29] gave the result of an excision in a case of old fracture of

the astragalus. His patient walked without fatigue or limp and the equilibrium of his foot was perfect.

Galavielle's[30] case of fracture of the astragalus was evidently a linear fracture without much displacement. The patient was thrown to the ground and could not rise. There was great immediate disability. One year after the injury, flexion, extension, and lateral movements were limited. The author says that fracture of the astragalus is frequent, and is caused by direct or indirect violence. Usually it is not accompanied by displacement, and heals early and rapidly.

Heger[31] described three cases of fracture of the calcaneum, one a tear fracture, two crush fractures. The treatment of crush fracture recommended is by plaster of Paris. Union is hard to obtain.

Destot[32] reports three cases of fracture of the calcaneum, two of them recent, and two cases of fracture of the inferior extremity of the tibia and of the astragalus. All were caused by falls on the feet from a height of two to five meters. In only one case of fracture of the calcaneum was the bone badly splintered, and in this case the prognosis was better than in the others. In one case there was very little deformity and the foot was not flattened. The two fractures of the astragalus were almost exactly alike, one being two and the other twenty months old. In both the foot was in varus, and the tibio-tarsal joint was ankylosed. A piece of bone four cm. long was torn from the anterior aspect of the tibia, and the foot was subluxated forward, giving it an elongated appearance. The hollows behind the malleoli were effaced, and those below the malleoli were partly so. Both patients had a permanent deformity which would diminish in time, but at the end of twenty months one patient walked with difficulty and used a cane. He was incapacitated for work. Resection of the astragalus was the only remedy to be advised for these patients.

Destot[33] also reported a case of old fracture of the astragalus in a man of thirty-five years, who fell about three feet, and was for five months treated for sprain. During this time the patient's condition had not improved. The author inclined to resection, but the patient would not permit it. The prognosis of these fractures of the astragalus differs according to the location of the fracture and the displacement of the fragments. They are all apt to be very tedious. If one articular surface of the bone is involved, the prognosis is worse than if both are. Destot propounds the question whether it would not be better in fracture of the astragalus, realizing the tediousness and long duration of the symptoms, to do an excision at the time of injury, rather than to wait for a year or two and then probably be obliged to do the operation.

Morgan[34] published a case of fracture of the astragalus with displacement of the posterior half, caused by a severe blow upon the thigh while the knee was flexed. Nothing as to treatment or result was given.

Urban's[35] case of fracture of the astragalus with dislocation backward of the posterior half, was in a glazier of fifty years of age, who fell from a height of twenty feet. The posterior part of the bone was dislocated. The tibia was forced through the fragments and rested on the

calcaneum. No exterior wound was present. The fragments could not be replaced even under an anæsthetic. Urban therefore laid bare the ankle by an incision on the inner side, divided the three tendons on the inner side of the foot, chiselled off the lower part of the inner malleolus, turned it down with the deltoid ligament, and brought the fragments of the astragalus into position. The tendons were then sewn, the malleolus brought into its proper place, the wound was closed, and plaster of Paris was applied. The results were excellent, the patient walking without the plaster in the sixth week. Urban says that with dislocation or fracture of the astragalus, the bone or fragment must be put in its proper place even if an extensive operation be necessary. The removal of the astragalus should rarely be done.

Neuhaus[36] reported eleven fractures of the calcaneum, ten apparently from fall on the feet, one a gun-shot fracture. The prognosis depends on the amount of damage to the bone. If the bone is badly crushed and the fragments are dislocated, the prognosis is bad; otherwise it is good. For treatment he recommends baths, massage, and exercise.

In Berard's case[37] of old fracture of the internal malleolus, etc., the injury had been caused by the fall of a heavy weight on the foot fifteen years previously. The patient had gone to work ten days later and but little deformity was then present. Two years afterward an abscess appeared at the site of the old wound. The description of this case leads one to doubt the correctness of the diagnosis. The bones of the tarsus were united in a solid mass, their outlines were lost, and they were hypertrophied and deformed. Rarifying osteitis was present in the posterior tarsal bones. The bone disease was accompanied by ulceration of the skin, club foot, ascending neuritis of the post-tibial nerve, and by severe trophic disturbance. The author himself seems uncertain as to the correctness of his diagnosis. The treatment was amputation !

Bouchet[38] reports a case of crush fracture of the calcanea with the classical symptoms. The patient fell from the third story, landing on his feet. Under chloroform an unsuccessful attempt was made to replace the fragments. The author recommends lateral pressure under anæsthesia to reduce the fractures. He considers that the symptoms following them are largely due to compression of the nerves and vessels under the bone.

Rollet[39] in 1904 published the report of a case of fracture of both calcanea. The patient was a mason, thirty-two years of age, who fell from the second floor, landing on his feet. The two ankles were said to have been forced into the bony masses which lapped over on the sides, and posteriorly the axes of the astragali were changed so that their heads, instead of looking forward and downward, looked forward and upward. The body of the astragalus was forced into the body of the calcaneum. The results were given as follows: First: the patient supports his weight on a heel composed of broken splinters of bone. Second: the mid-tarsal joint is opened up and is kept in a state of inflammation. Third: the arch of the foot is depressed.

Eisendrath[40] has recently published a case of tear fracture; the treatment consisted of suturing with kangaroo tendon.

In many of the above reviewed cases in which no X-ray photographs were taken, the diagnosis would seem to have been based upon conjecture and supposition rather than upon certainty.

Author's Cases.—Judging from the history of the author's cases, seventy-six per cent. of them had been improperly diagnosed at the time of injury. Fifteen of the patients were men, one was a woman, one, a boy of fifteen. Six had a fracture of the left calcaneum, five of the right, one of both calcanea. Three had a fracture of the right astragalus, one of the left. One patient, the woman, had a fracture of both calcanea and of the left astragalus. Two of the fractures of the astragalus, and one of those of the calcaneum, were associated with a fracture of the tibia.

The history was the same in every case. All the patients had fallen from a height, usually greater than ten feet. They had been carried to their homes or to the hospital, and had been confined to their rooms from three to six weeks or more, those with fracture of the astragalus being disabled usually for a somewhat longer time than those with fracture of the calcaneum. In three other cases, which presented some of the symptoms of tarsal fracture, and which were at first regarded as possible cases, the usual history of a fall from a height, with extreme immediate disability could not be obtained. One was probably a case of syphilitic periosteitis; one was a bruise, and the other was a severe sprain. In Case II the patient gave a history of being struck by a barrel, only mentioning the fall on his feet when he was closely questioned. Case V. was treated at first with a wrong diagnosis. This patient also admitted afterward the fall on his feet. Numerous authors have taught that fracture of the calcaneum can be caused by muscular action, and that the bones of the tarsus can be fractured by various kinds of direct violence; and they are undoubtedly correct. But, on the other hand, it may be said that if a man falls from a height and lands on his feet, and if he is then unable to walk home and is confined to

his bed with great pain and swelling in his heels and in his ankles, a strong presumption, at least, of fracture of the calcaneum or of the astragalus is justified. If the patient be seen for the first time several months afterward and, besides giving the characteristic history, says also that he was confined to his bed for a month or two, and has since suffered from pain and stiffness in his heel or in his ankle; it is possible to tell almost with certainty, before he takes off his shoes, that he has a tarsal fracture, It is a great mistake to regard these fractures as rarities. They are. on the contrary, very frequent, and doubtless are responsible for much of the odium that attaches to a sprained ankle.

Cases VIII and XVII were seen at the Ruptured and Crippled Hospital; all the other cases at the Roosevelt Hospital, O. P. D.

Case I.—John Daly, aged fifteen, a schoolboy. Old fracture of left tibia and calcaneum. The patient fell about two months ago from a height of four stories, and landed on his feet. He was carried to the hospital and was confined there for six weeks. Examination shows old united fracture about two inches above the lower end of tibia, abduction of the heel, thickening about the calcaneum, and obliteration of the concavities under the malleoli. Treatment, strapping.

The X-ray shows probable fracture of sustentaculum tali.

Case II.—Thomas Breese, aged forty-nine, a carpenter. Old fracture of right calcaneum. Four months ago the patient "sprained" his right ankle by a fall on his feet from a height of twelve feet. He was carried in an ambulance to the hospital, and was confined there for three weeks. Since then he has suffered from pain and stiffness in his right foot. Examination shows the heel in peculiar abduction. The normal concavities under the malleoli are not present. The calcaneum is thickened.

The skiagram (Fig. 1) shows a probable fracture of the sustentaculum tali.

Case III.—Thomas Lacey, aged sixty years, a driver. Old fracture of the right calcaneum. Four weeks ago the patient jumped from a truck and hurt his right ankle. He reached

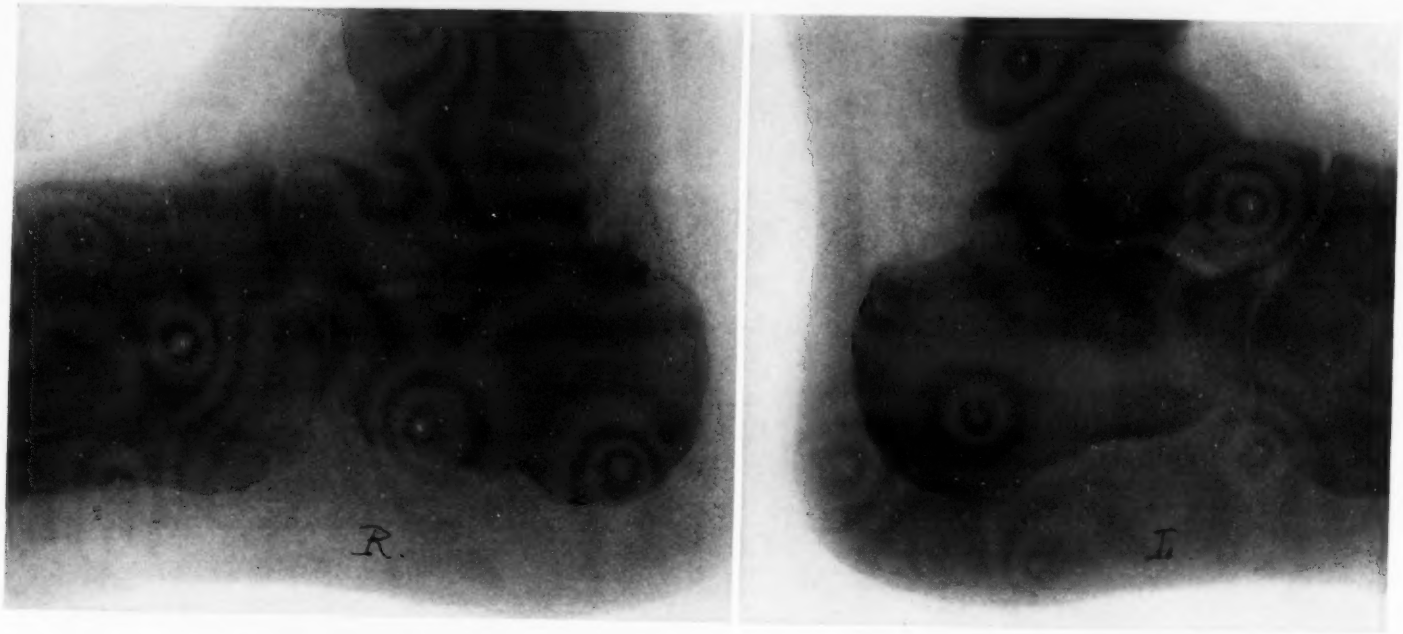

FIG. 1.—Old fracture of right calcaneum. See Case II. Normal bones of left tarsus shown for purpose of comparison.

FIG. 2.—Old fracture of right astragalus and calcaneum. See Case III Normal bones of left tarsus shown for purpose of comparison.

FIG. 3.—Old fracture of both calcanea. See Case IV.

FIG. 4.—Old fracture of left calcaneum. See Case VII. Normal bones of right tarsus shown for purpose of comparison.

home with the aid of a broom for a crutch, and was confined there for four weeks. Now he suffers pain under his external malleolus and about his heel when he walks. Examination shows peculiar abduction of the heel, disappearance of hollow under the external malleolus, and thickening of calcaneum. Treatment, massage.

The X-ray (Fig. 2) shows an old line of fracture of the calcaneum through the body of the bone.

Case IV.—Whitfield Mabey, aged forty-four years, a conductor. Old fracture of both calcanea. The patient was thrown off a freight car six months ago, landing on both heels. He was carried to the hospital, and stayed there for thirty-eight days, suffering great pain. He says that both heels were swollen, and were black and blue. His injury was diagnosed sprained ankles. Since leaving the hospital the patient has been incapacitated for work. Examination shows both feet abducted; adduction painful; slight thickening is present about the heels.

The X-ray (Fig. 3) shows fracture of both calcanea, probably of the sustentaculum tali.

Operation was advised and refused. The treatment consisted of strapping and shoes. Later the strapping was removed and the heels were massaged and were soaked in hot and cold water. A Whitman brace was applied on one foot. At last notice the patient was at work, but was unable to pursue his former occupation.

Later: Patient announces that he cannot work, and has put in a claim for accident insurance on the ground of total disability.

Case V.—William Donald, aged thirty-seven years, a stone-setter. Old fracture of right tibia and fibula, and of left tibia and right calcaneum. Six weeks ago the patient's legs were squeezed in an elevator. The accident caused a compound fracture of both bones of the right leg, and a simple fracture of the left leg. The patient was confined to the hospital for four weeks and had his plaster of Paris removed this morning. Examination: Union, in good position, of the fractures of the leg bones. Thickening under external malleolus of the right foot, peculiar abduction of the ankle; motion of the ankle free. Normal hollow absent under external malleolus. Internal malleolus prominent. Patient now admits having fallen three

stories three years ago, landing on right foot. He was in the hospital fourteen weeks after the fall.

X-ray shows smashing of the calcaneum, probably true impaction.

Case VI.—Joseph Kennedy, aged forty-two years, a laborer. Old fracture of left calcaneum. Three weeks ago patient fell from a height of twenty feet, and landed on his feet. He was carried home, and has been confined to the house ever since. He says he was "black and blue" under the ankles. Examination: Patient limps; his gait appears painful. Slight thickening is present under the external malleolus of the left foot, with extreme sensitiveness to pressure. There is no marked deformity. Treatment, strapping and massage. Under this treatment the patient improved somewhat.

The X-ray shows evidences of old fracture, little more than a slight irregularity of structure of the calcaneum.

Case VII.—Frank Duberstine, aged twenty-four, a clerk. Old fracture of the left calcaneum. Two and one-half months ago patient fell one story and landed on his feet. He was carried home and was confined to his house for five weeks. During this time he suffered pain in his left ankle. He complains now of pain and stiffness. Examination shows abduction of the heel and disappearance of the hollows under the malleoli, and a thickening most marked under the external malleolus.

Later, a Whitman brace was applied and was of some benefit.

The X-ray (Fig. 4) shows a fracture of the anterior process of the calcaneum, perhaps also a slight amount of impaction.

Case VIII.—Lewis Barken, aged twenty-four years, an operator. Old fracture of the right astragalus. Three years ago the patient fell down an elevator shaft, landing on his feet. He was carried to the hospital, and was there for four months, with a diagnosis of "fracture." He says his right foot was "twisted inward." The treatment was with plaster of Paris. Since then the heel has been painful and stiff. Removal of the astragalus was advised; but the patient refused his consent.

The X-ray (Fig. 5) shows great crushing of the astragalus in the posterior part, and fracture of the tibia.

Case IX.—Christopher Cheyne, a derrickman. Old fracture of right astragalus. Ten weeks ago the patient fell one story. He was taken home in an ambulance, and was confined to the

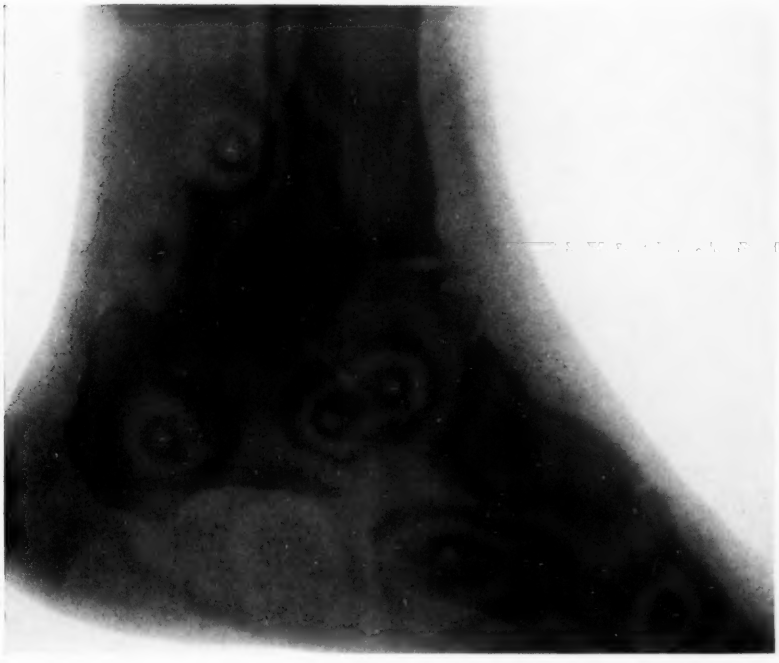

FIG. 5.—Old fracture of right astragalus. See Case VIII.

house for seven weeks with pain and swelling in his right heel. Since then he has suffered pain on walking. Examination shows thickening and stiffness about the ankle. Dorsal flexion is limited. There is no heel abduction nor obliteration of the normal concavities. Treatment, strapping.

The skiagram shows slight irregularity of the posterior part of the bone.

Case X.—William Curran, aged fifty-six years, a boatman. Old fracture of calcaneum. The patient fell in hold of boat five weeks ago, and landed on his left heel. He was in plaster of Paris for two weeks. "They claimed something was broke." Since then he has had pain and has limped. "Something was loose in heel." Examination shows thickening over the calcaneum. Treatment, strapping and shoes. On April 19, one month later, the patient had improved, but still suffered some pain. Hot and cold water was recommended. July 25, slow improvement; very little pain.

The skiagram shows a beautiful example of impaction of the calcaneum. The astragalus is also probable damaged in its posterior part.

Case XI.—William Fried, aged twenty-seven years, a machinist. Old fracture of left astragalus. Four months ago patient suffered a compound fracture of both bones of his left leg by being struck with a barrel. He was operated on in the Roosevelt Hospital. Examination shows a linear scar on the front of the shin, and another scar on the internal aspect of the leg, abduction of the foot, and thickening about the heel, and also limitation of abduction. The patient now says that he fell down stairs and that then the barrel fell down and struck him. The astragalus can be felt close up under the internal malleolus. Extension and flexion are limited at the ankle; they come to a sudden "bony" stop. Treatment, strapping and shoes. Two months later the foot was markedly improved; the patient was at work, and had good motion in his ankle.

The skiagram shows an old fracture of the body of the bone without much displacement.

Case XII.—George White, aged thirty-nine years, an iceman. Old fracture of the left calcaneum. Patient says that he sprained his left ankle two months ago, and that since then he has suffered pain in it and has limped. The "sprain" was caused

by a fall from a height of ten feet. The patient landed on his feet when he fell. Examination shows thickening about the calcaneum, abduction of the heel, and disappearance of the hollows under the malleoli. Treatment, strapping.

The skiagram shows a slight change in contour of the calcaneum, probably a fracture of the sustentaculum tali.

Case XIII.—Edward Davey, aged forty-three years, a carpenter. Old fracture of right calcaneum. Three months ago patient fell a distance of fifteen feet and landed on his right foot. He was carried to the hospital and stayed there for over four weeks. His leg was encased in plaster for six weeks. The diagnosis seems to have been Pott's fracture. Since then the patient has suffered with pain and stiffness in his ankle. Examination shows the classical symptoms—thickening under the malleoli, obliteration of concavities, and abduction of the heels. Motion is not limited at the ankle. Treatment, strapping and shoes.

The X-ray shows fracture of the anterior process of the calcaneum, probably into several pieces.

Case XIV.—Patrick Lynch, aged thirty-six years, an electrician. Old fracture of the right calcaneum. Five months ago the patient fell about twenty feet, landing on his right heel. He was put up in plaster of Paris and went on crutches for five weeks. "They thought a bone was broken in the heel." Since then he has suffered from pain and has been disabled. Examination shows peculiar abduction of the right heel, filling out of hollows under malleoli, with thickening of the bone. Motion in the ankle joint is free. Treatment, strapping and shoes.

In the skiagram the sustentaculum tali appears to be fractured.

Case XV.—Robert Wheelhouse, aged forty-seven years, a machinist. Old fracture of right astragalus. Five months ago the patient fell from a scaffold at the height of five feet and landed on his right foot. He was carried to the hospital and was laid up for six weeks, with a diagnosis of " fracture of the ankle." Since then he has suffered pain in the ankle and has been disabled. Examination shows no peculiar abduction nor obliteration of the concavities. Bony thickening is present under the malleoli, in front of them, and behind them; and the malleoli are nearer the sole than normal. Motion in the ankle joint is

FIG. 6.– Old fracture of left calcaneum. See Case XVI. Normal bones of right tarsus shown for purpose of comparison.

FIG. 7.—Old fracture of both astragali and calcanea, with impaction. See Case XVII.

practically nil. At last accounts the patient said he was improving with massage and hot and cold water.

The skiagram shows crushing of the body of the bone with displacement of the fragments.

Case XVI.—Lorenzo Cooper, aged fifty-six years, a watchman. Old fracture of left calcaneum. Eight months ago the patient fell twenty-two feet out of a window and landed on his left heel. He was carried in an ambulance to the hospital where he stayed for four weeks, and where he was treated with plaster of Paris. Apparently the diagnosis was fracture of the astragalus. He has been lame ever since, and has suffered pain in his ankle and in the sole of his foot. Examination shows marked thickening about the heel and disappearance of the normal concavities under the malleoli, the curved line being replaced by a straight one, so that the tops of the malleoli, cannot be distinguished. No peculiar abduction can be recognized, but both feet are flat. Plantar flexion is limited; dorsal flexion is not. Treatment, strapping.

The skiagram (Fig. 6) shows impaction of the anterior two-thirds of the calcaneum; probably crushing of the astragalus also.

Case XVII.—Miss W., aged thirty-nine years, a milliner. Old fracture of both calcanea; old fracture of left astragalus. Three months ago, in delirium, the patient sprang out of a second story window, thinking that she was pursued. She landed on both feet, and was carried to the hospital in an ambulance. There she stayed for eight weeks, suffering from pain and swelling in both ankles and heels. She says her complaint was diagnosed as sprain, and that she was treated with lotions. She began to walk in the fourth week, and has since complained of pain in both heels and in her right ankle. The right foot is the more painful, and the seat of the greatest pain in this foot is in the neighborhood of the external malleolus. The patient now wears broader shoes than before her injury, though of the same length, and is compelled to use crutches. Examination at the Hospital for the Ruptured and Crippled: Both heels are markedly thickened, the left more than the right. This thickening is perceptible to sight and to touch. The normal hollows under the malleoli and at the sides of the tendo Achillis are absent in both feet. The left foot is adducted; the right foot is slightly

abducted. The outlines of the malleoli cannot be made out. Motion in the left ankle is decidedly restricted. Treatment; operation advised, but not permitted.

The X-ray (Fig. 7) shows marked impaction of the anterior portion of the calcanea, and crushing of the left astragalus.

Symptoms of Tarsal Fracture.—The most important symptom of old fracture of the calcaneum or of the astragalus is a thickening of the heel, much more easily detected if the patient presents a sound heel on the other side for comparison. The thickening can be perceived better by palpation than by inspection. Rarely is it possible to tell from the location of this thickening which bone is fractured. The malleoli are nearer the ground than in the normal foot, and their outline cannot be distinctly made out. In fracture of the calcaneum the normal concavities under the malleoli are obliterated, and their place is taken by lines more or less straight. In fracture of the astragalus motion is, as a rule, limited at the ankle. In fracture of either bone the hollows at the sides of the tendo Achillis are usually filled out. Often a peculiar abduction of the heel is present in fracture of the calcaneum, quite different from the eversion of the ordinary flat foot. This form of flat foot, characteristic of the lesion, is readily explained on the hypothesis of fracture of the sustentaculum tali, for the astragalus, deprived of its support on that side, sinks inward. We should expect then, perhaps, that the internal malleolus would be depressed more than the external, as some writers maintain to be a fact. Probably they were dealing with this form of fracture. Others say that the external malleolus usually sinks the more; but they also find that the foot is flattened. Probably these were dealing with impacted fractures in which the external part of the bone suffered the greater damage. Ehret, in maintaining the greater descent of the exterior malleolus, explains the mechanism of this impaction of the outer portion of the bone, and attempts very cleverly to reconcile seemingly

conflicting views. In point of fact, neither malleolus "sinks" more than the other, except in relation to some part of the tarsus. *As long as the bones of the leg remain intact both malleoli must sink together.* This simple fact seems to have escaped notice.

In fracture of the astragalus the foot is regularly in adduction. The interesting question suggests itself, whether this adduction in fracture of the astragalus, and the abduction in fracture of the calcaneum are merely symptoms, or whether the position which the foot is in at the time of the injury stands in a causal relation to the resulting fracture.

The skiagrams of these fractures are much more easily interpreted if both feet be included in the p cture. They are best taken from the lateral aspect. Although it is not always possible to tell by means of the X-ray the exact line of fracture, most of the author's cases of fracture of the calcaneum seem to belong in one of two classes: First, fracture of the sustentaculum tali; and, second, impaction of the body of the bone. In Case XIII the greater process seems to have been broken into several fragments. In fracture of the astragalus true impaction is not demonstrable, probably it never occurs. The bone is cracked between the calcaneum and the tibia, as is a nut in a nut-cracker. If the force continues, the bone is divided into pieces, sometimes many in number. These fragments may be displaced in various directions. The posterior portion of the bone generally sustains the greater damage. In Case VIII, with the foot in slight plantar flexion, the posterior portion seems to have been split off on the sustentaculum tali, and to have been dislocated backward. In Case XV the whole bone is, so to speak, flattened out by the impact of the tibia, again just as a nut would be crushed by a hard blow from a hammer. One of these patients with crushing of the astragalus fell from a great height, but the other only a few feet. Both patients, however, were quite stout.

Prognosis.—The prognosis of fracture of the tarsus, when treated in the usual way, namely, as a sprain or as a fracture of one of the leg bones, is distinctly bad. Most of the author's patients with fracture of the calcaneum were more or less disabled, and in not more than one case was the foot completely restored to function. It is not necessary to ascribe entirely the resulting disability to a loss of pronation and supination in the mid-tarsal joint (Ehret), though this may aggravate the symptoms. Nor do we need to accept the teachings of some of the French writers, that the trophic disturbances in the tissues beneath the heel are mostly to blame. In walking, the calcaneum bears the entire weight of the body, receiving a blow with each step; and in standing it bears a great part of the weight. The slightest change in the structure of the bone can readily cause great discomfort (Bähr). A small exostosis on its lower surface would have much the same effect as a loose stone in the heel of the boot. Again, almost invariably, except with tear fractures of the posterior part, some joint of the calcaneum is involved in the fracture, and is therefore distorted.

In fracture of the astragalus, the prognosis depends largely upon the amount of dislocation of the fragments. Cases VIII and XV of the author's series in which there was much displacement, have an absolutely stiff ankle, and are incapacitated for work. Case XI, with but little displacement, had a good result, and the patient pursues his occupation of chauffeur with little difficulty. Case IX, also without much displacement, when last seen was doing fairly well. Case XVII had a small amount of motion in her ankle, but complained of more discomfort in the foot in which the astragalus was not fractured. In none of the author's cases was the fracture compound. In compound fracture the prognosis might be different.

Treatment.—It appears from the foregoing that the treatment of these old fractures is unsatisfactory. Hot and cold baths, massage, strapping, and occasionally a

Whitman brace, may be tried, sometimes with fair results. In fracture of the astragalus with dislocation of the fragments, removal of the bone offers the only relief (Destot, Vegas, and others). In fracture of the calcaneum, with an exostosis in the sole, the protruding piece of bone can be chiselled off (Bähr).

The best results in the treatment of crush fractures are to be obtained at the time of their occurrence. With an impacted fracture of the calcaneum the impaction should be broken up if possible, and the foot should be put up in adduction and dorsal flexion. Bouchet's recommendation of lateral pressure to break up the impaction is worth trying. In fracture of the sustentaculum tali, the indication is clear; strong adduction and dorsal flexion will cause the astragalus to pull this process back into its place. The foot should be fixed in that position.

In fracture of the astragalus without displacement of the fragments, the main indication is strong dorsal flexion. When the fragments are displaced, their dislocation should be reduced, if necessary by an open operation. In this connection compare Cases VIII and XV of the author's series, in which the fragments were not replaced, with Urban's similar case, in which the ankle was opened and the dislocated portion of the bone reduced. In the first two cases the patients have a stiff ankle, in the last, Urban reports a complete recovery with a good joint. If the fragments cannot be replaced, they should be removed.

A good general rule in all tarsal fractures where the facilities for making an exact diagnosis are lacking, is to put the foot up in extreme dorsal flexion, and in inversion.

The best form of splint, after the primary swelling has subsided, is one of plaster of Paris, reaching from the bend of the knee to the toes. Under no circumstances should the patient bear any weight on his foot before the expiration of two months.

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COLOSSAL DERMOID CYST OF OVARY OF OVER FIFTY YEARS' GROWTH.

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THE accompanying illustration is contributed as an exhibit of a dermoid cyst of the ovary of unusual size and duration of growth, since cysts of that class seldom exceed in size a man's head.

The subject was a maiden lady, 60 years of age, in whom an enlargement within the abdomen was first noticed when she was ten years of age. It was then attributed to a fall sustained a short time previous. It slowly increased in size and made the greater part of her life one of invalidism. She finally, in September, 1906, entered the Danbury Hospital, that the tumor might be removed. This was done happily, September 17, and was followed by an uncomplicated recovery. The weight of the cyst and its contents was 32 pounds. The photograph (Figure 1) was taken immediately before the operation.

FIG. 1.—Dermoid cyst of ovary of fifty years' standing. Weight 32 pounds. Prompt recovery. Removed at Danbury Hospital September, 1906.

EXTIRPATION OF A HYPERNEPHROMA, WEIGHING FOUR AND A QUARTER POUNDS, FROM AN INFANT TWENTY MONTHS OF AGE.

RECOVERY.

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OF AUBURN, N. Y.

THE patient, a boy aged one year and eight months, was referred to me by Dr. M. P. Conway, Aug. 26, 1906. Family and personal history unimportant. Four months ago mother observed veins of right testis were swollen. Gradual enlargement of the abdomen followed. Appetite fair, and bowels acted normally. No urinary disturbance. Though irritable and fretful, child seemed not to have pain. Chief complaint, swelling of the abdomen.

Examination showed an infant thin but not emaciated, and pale but not cachectic. Abdomen enormously distended by a soft, solid growth, smoothly rounded everywhere except in the right flank, where a knotty mass was perceptible. Flatness everywhere on percussion, and a thrill on tapping the surface. No tenderness. Urinalysis shows no albumin or sugar, and no pus, blood, or other morbid deposit.

Operation, Aug. 29.—Ether. Patient in Trendelenburg position, as recommended by Abbe, to lessen bleeding and to keep the blood in the head after release of the abdominal vessels from pressure by the growth, thus diminishing shock.

In view of the great size of the tumor I selected the transperitoneal method, splitting the right rectus muscle from the costal arch nearly to the pelvis. The lumbar incision seemed to me not to offer so good access to a mass filling the belly, while the injury to the abdominal musculature would necessarily be greater, as the muscle fibres must be in part divided.

Statistics of the two operations give (Kuester) a mortality of 26.62 per cent. for the transperitoneal, and 24.70 per cent. for the loin incision. Even if this statement is accurate—and Jonnesco in 17 operations had a lower mortality from the transperitoneal route—the figures mean simply that it was the larger

and more complicated growths that required access by laparotomy, the higher mortality depending on the inherent difficulty of the cases, not on the operative method employed.

The statement that cases operated by the loin give one-half more permanent recoveries than those operated by the anterior route, is doubtless to be similarly explained.

The rectus opening gave a good view of the mass (Fig. 1), which with huge veins coursing over its surface presented a formidable appearance. Perpendicularly on its anterior face lay the ascending colon, lifted along with the posterior layer of peritoneum, behind which the tumor had developed. The other intestines were crowded over to the left, out of sight. In the peritoneum, constituting the anterior covering of the mass, an opening was made with scissors to the right of the colon (in order not to jeopardize its nutrient vessels coming from the left). Through this opening, by finger dissection, the peritoneum with the ascending colon was stripped from the tumor. Bleeding was free during this step, and required pressure with hot gauze to control. Indeed, the greater part of the blood supply of the growth seemed to come from these peritoneal vessels enlarged to meet its needs. Working behind to the right, I found and freed the kidney, and then by pressure on the outside of the abdomen, the tumor, *plus* the kidney attached by its upper pole, were delivered through the incision, which, generous as it was, had to be widely stretched to permit the extrusion of the mass. As this emerged it revolved to the right, like a geographical globe, exposing the pedicle, consisting of renal vessels, etc. (Fig. 2). An infected gland was disentangled from their midst, and then a catgut ligature applied, and the mass cut away.

It would have been possible in this case, I think, by a plastic resection to have preserved the portion of kidney not implicated in the growth, as was done by Abbe in one of his cases. But the child's condition became so bad that choice was made of the most rapid means of ending the operation.

Inspection now showed that the mesocolon stretched over the left side of the tumor had in the process of enucleation been torn from its gut for a space of some four inches. Here, too, there was no time for other course than to rejoin it as rapidly as possible to the colon, and hope for anastomotic restoration of the blood supply,—a hope happily justified by the event.

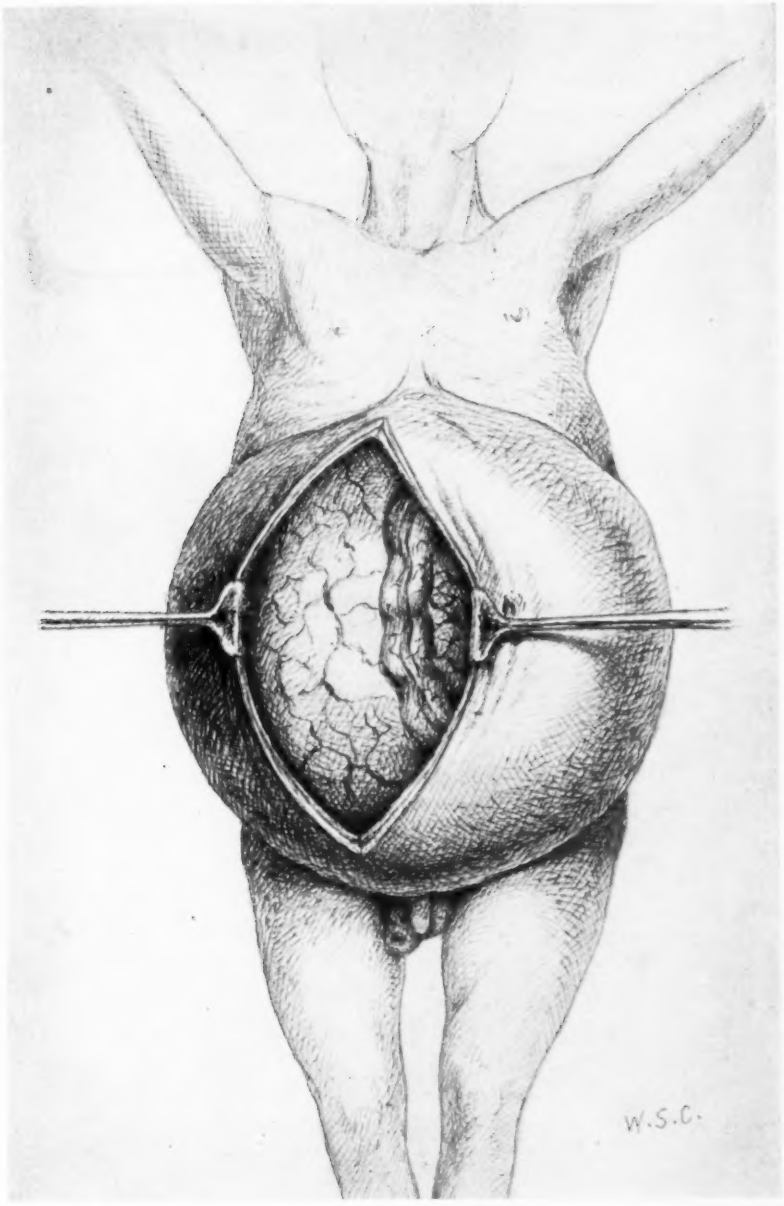

FIG. 1.—Appearance of tumor on opening abdomen. Note ascending colon and varicocele.

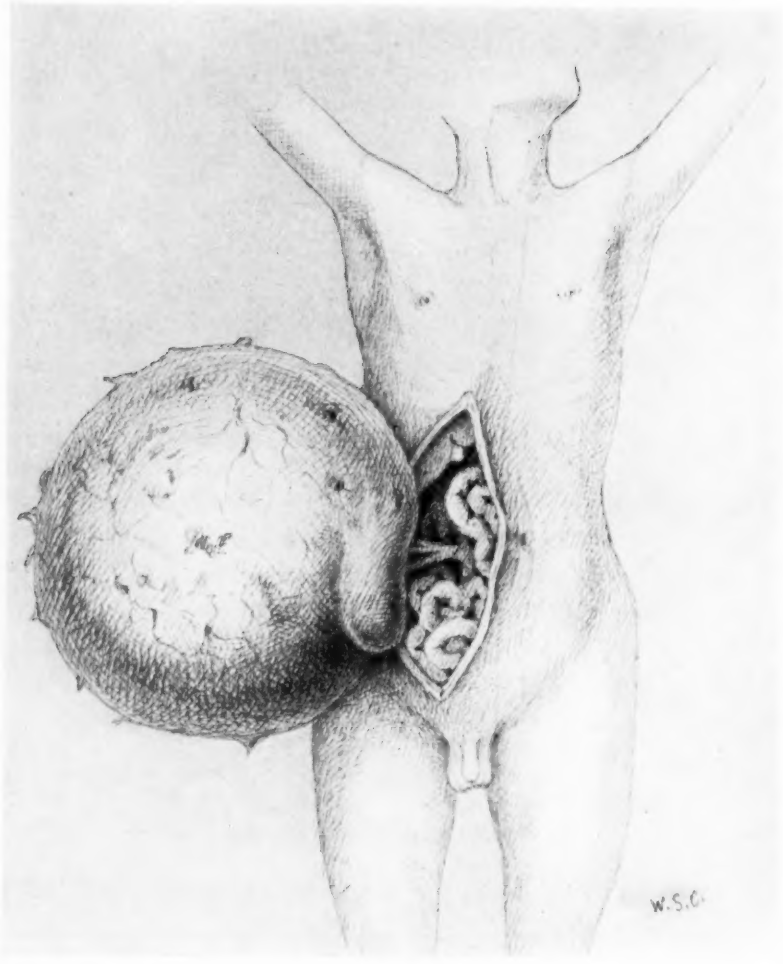

FIG. 2.—Schematic view of tumor delivered, still attached by pedicle. Note right kidney and tumor attached to its upper pole.

The opening made by scissors in the posterior peritoneum went for similar reason unsutured. The abdominal cavity was filled with hot saline, and the wound of entry quickly closed in tiers. Thus the child got off the table deeply shocked, but alive, which was almost more than had been hoped. Time of operation, 32 minutes.

Hypodermic stimulation, coffee and whiskey by rectum, patient placed at a slant, head down in bed. Temperature 102° in the evening, but fell to normal next morning, and remained there. Recovery was in all respects uneventful. The patient now taking on weight and looking rosy.

The tumor weighed four and a quarter pounds. Dr. Sondern to whom a specimen was sent for sectioning reported it to be hypernephroma.

One of the latest reviews of the prognostics of operation for malignancy of the kidney is contained in the "Handbuch der Urologie," 1905, edited by Frisch and Zuckerkandl. The writer (Paul Wagner) finds the operation-mortality much reduced in recent years,—from 61.22 per cent. (Gross) to 24.44 per cent. (Kuester). Schmieder's statistics gives 64.3 per cent. operation-mortality in the first decennium of renal surgery, 43 per cent. in the second, and 22 per. cent. in the third. But the mortality among children is still 28.1 per cent.

As regards permanence of cure the literature furnishes but 34 cases living beyond the two-year limit *recidiv-frei;* and 21 cases beyond three years,—16 adults, 5 children.

So that while the case reported may be regarded as a fortunate instance of operative recovery, permanency of recovery can be affirmed only after some years.

INTRAPERITONEAL RUPTURE OF THE URINARY BLADDER.

WITH REPORT OF A CASE OPERATED TWO HUNDRED AND FIFTY-FOUR HOURS AFTER ACCIDENT; WITH RECOVERY.

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On Sept. 28, 1904, a man was brought to Cook County Hospital, Chicago, with intraperitoneal rupture of the urinary bladder. Eleven days previous to admission he had received an abdominal injury, since which he had suffered from anuria and a progressive abdominal distension. He was operated two hundred and fifty-four hours after the accident, and was discharged from the hospital on the tenth day well.

The time element is the important and interesting feature in this case. It is unique in medical literature. Two hundred and fifty-four hours after the abdominal injury laparotomy was performed, the bladder sutured, and the patient made an uneventful recovery. Blumer (*British Med. Journal*, 1903, 1, 789) reported a case operated the sixth day after injury, with recovery. I believe Blumer's case has the longest intervening time from injury to operation of successful cases reported to date.

CASE REPORT.—F. G., a laborer, 45 years of age, was brought to the receiving ward of Cook County Hospital in the police ambulance, Sept. 28, 1904, at 6.17 P. M. He stated that ten days previous to admission he had been carousing and drinking during almost the entire night. About 4 A. M. he became involved in a brawl and was kicked several times in the right side just above the crest of the ilium and about the trochanter major. He had considerable pain in the abdomen and at the seat of injury at the time, and had to be taken home. In a few hours he felt better and tried to work for the following two days. But

the pain in the abdomen became so severe that he had to quit work on the second day. About the time he quit work he noticed that the abdomen was somewhat distended and since that time the swelling had gradually, but slowly, increased in size. Ever since he was injured he has been unable to void much urine, but has had very frequent desire to urinate, only a few drops being voided at a time. Since the injury what urine he has passed has been distinctly bloody. For the past eight days the abdominal pain has been very severe, and he has vomited several times a day. He thinks he has had no fever since the injury. There is a distinct alcoholic history extending over many years.

He was a fairly well developed, middle-sized man, past middle age of life. He lay on his side with legs drawn up. He complained of great distress in his abdomen and vomited during examination. Skin dry and cool. Pulse considerably accelerated, regular but very weak. Respiration somewhat rapid. Abdomen markedly distended, tense, with shining walls. Umbilicus protruding, subcutaneous veins prominent. On palpation there was some tenderness over entire belly. Percussion showed dulness over entire abdomen. A distinct impact was given on tapping the abdominal wall anywhere. There was no evidence of contusion of abdominal wall. Remaining examination had no points of interest.

The catheter was then passed and 5,800 cc. of blood-tinged urine was withdrawn. Abdominal distension disappeared and tympany obtainable, but still signs of fluid in abdomen. The record at this time shows temperature, 98; pulse, 108; respiration, 24. Patient was sent to operating room. The following notes are taken from history sheet:

"*Operation.*—Operator, Dr. George F. Thompson. Incision in median line four inches long, beginning one inch above symphysis pubis. Abdominal cavity opened. About 2,000 cc. bloody urine found free in peritoneal cavity. On superior surface of the bladder in median line was an opening with ragged edges, which admitted the thumb rather tightly. Opening in bladder sutured by Czerny-Lembert method, using medium-sized silk sutures. Abdominal cavity flushed with normal salt solution. Serosa smooth and shining. Peritoneum and abdominal wall closed by separate layer method."

Bladder was drained for five days by means of catheter through urethra. The patient made an uneventful recovery, temperature never being above 100.6°.

It is noteworthy in this case that the patient performed his work as a laborer an entire day after the accident, and was not compelled to take to bed until the second day was well advanced. The symptom of shock was entirely absent, it being most probably that the patient had to be taken home after the injury more on account of intoxication than on account of the injury itself.

Yet, it is well known that serious injury to persons under the influence of alcohol often lacks just this element of shock, which is so important in the diagnosis of internal injuries. So, too, is rupture of the urinary bladder a relatively common occurrence in intoxicated persons, owing to the distension of the organ and to the dangers of trauma in this condition. On this point I quote Dr. Ashhurst (*Am. Jour. Med. Sc.*, July, 1906).

> Another predisposing cause of importance is the condition of intoxications. Over 72 per cent. of the patients in whose records this point is mentioned, are reported as being more or less drunk at the time of the injury, and it is a sad fact that in not a few instances in which the patients themselves were sober, they sustained their injuries because of intoxication in some one else (Rose, Zoldewitch). Not only does drunkenness predispose to injury in this way, by making the individuals both quarrelsome and unsteady on their feet, but it increases the amount of urine excreted, and by dulling the sensibilities renders the persons so affected often unconscious that their bladders are overdistended, and may even deprive them, when drunkenness is a long continued habit, of the power of completely evacuating their bladders. The result of this last state—atony of the bladder—is that, although the patient may have passed his urine within an hour or so of the accident, his bladder may still be quite sufficiently distended to predispose it to rupture when subjected to sudden injury. Another serious aspect of intoxication in these patients is that they frequently remain unconscious of the gravity of their injury, as in the case of my own patient, and sleep off their drunken state only to awake the next morning with a peritonitis fully developed, which could almost certainly have been prevented by prompt operation.
>
> It is worthy of note that among the patients who were intoxicated at the time of the accident, the mortality was over 43 per cent; while among the sober it was less than 28 per cent.

I shall not follow further the questions of symptoms and diagnosis, because these points have recently been exhaustively treated in Dr. Ashhurst's paper.

Herrick[25] reported the cases occurring in Cook County Hospital, 1889 to 1893. Out of a total of 8,000 surgical cases there were five of rupture of the bladder; an incidence of .0625 of 1 per cent. St. Bartholomew's Hospital report, quoted by Herrick, mentions but two cases out of 16,711 surgical cases occurring in the years 1869 to 1875, an incidence of .0125 of 1 per cent. At the Episcopal Hospital, Philadelphia, from January 1, 1900, to January 1, 1905, there were 8,367 surgical patients with three intraperitoneal ruptures of the urinary bladder, or .037 of 1 per cent. (Ashhurst).

The question of cirrhosis of the liver with ascites was brought prominently to the fore in discussing the differential diagnosis of this case. With the marked alcoholic history, the enormous distension of the belly with fluid, prominent veins—these spoke volumes for portal obstruction. The history of injury eleven days previous made one hesitate to pronounce rupture of the bladder on account of the good general condition of the patient, for the common text-book leads one to expect a rapidly fatal issue. However, Ullman cites from the literature a case which died on the sixteenth day. A case is recorded by Ledderhose which survived the immediate results of the injury, and recovered after the opening on the seventeenth day, of an intraperitoneal abscess in communication with the bladder.

The sudden development of ascites following trauma, the strangury, blood from urethra, and the practical anuria for eleven days made the diagnosis of intraperitoneal rupture of the urinary bladder the most probable. The passage of the catheter was decisive.

The academic question of peritonitis following rupture of the bladder is an interesting one. If an aseptic urine does not produce peritonitis in eleven days, how many days are necessary? I believe the proposition that peritonitis is

not an inevitable sequence is easily tenable. Therefore, soundings and catheterizations must always be made with utmost caution in all suspected cases.

Samuel Alexander[1], in reporting forty-five cases, his own and from the literature, stated that the time elapsing between accident and operation varied from two to ninety hours. Until Blumer's[2-4] case on the sixth day with a successful issue, ninety hours was the longest time elapsing. In this reported series of forty-five, twenty-three died,—sixteen from peritonitis, two shock, two hæmorrhage, one pneumonia, and two died on table. In four cases peritonitis was due to imperfect suturing. In eighteen cases no drainage was used,—nine recovered, nine died. In twenty-one cases catheter introduced into bladder and retained several days,—eleven recovered, ten died. Two cases, bladder drained by suprapubic method, and both recovered. Jones[2] added nine cases to the Alexander series, and, in commenting on these, states[4]: Thirty-two reported prior to 1893 had a death rate of 63½ per cent.; twenty-two reported since 1893 had a death rate of 27½ per cent.,—thus showing an improvement of 36 per cent.

In Ashhurst's recent report of one hundred and ten cases sixty-three patients recovered and forty-seven died, a mortality of 42.72 per cent. To this series we may add Marnock's two with no mortality, M. L. Morel's four cases with one death, and the case herein reported, making a total of one hundred and seventeen. Of these sixty-nine recovered and forty-eight died, a mortality of 41.02 per cent. for all reported cases. If to Jones' twenty-two cases reported occurring since 1893 we add the seven recent cases, out of a total of twenty-nine seven died, a mortality of 24.1 per cent. Thus we note the gradually lessening rate of mortality under asepsis, and modern methods of diagnosis and treatment.

Willett[9] reported a case in 1876, Heath[9] in 1879, Bull[9] in 1885, all three dying from imperfect suture. McGill[9] reported a case in 1886 which died from operative shock.

MacCormac[1,2] in 1886 reported two cases, the first successful ones on record, in which there was celiotomy and suture. He ascribed his success to the fact that he sutured only the musculature and serosa, while previous operators had always included the mucosa. Before MacCormac's triumph in bladder suturing, practically all patients with intraperitoneal rupture were doomed to die. Ullman[16] collected 143 cases prior to 1886, only two of which recovered.

While a complete analysis of the literature with reference to the mechanism in intraperitoneal rupture of the urinary bladder was not made, the most common is from blows on belly wall by some blunt instrument, the booted foot playing a prominent rôle.

Intraperitoneal rupture also occurs in fracture of the pelvis from crushing injuries, but is usually associated with extraperitoneal rupture as well. Sugetinow[3] reports a case of intraperitoneal rupture due to heavy lifting. During the excessive physical effort the patient felt a sudden, tearing pain in the lower abdomen. The patient lay in bed five days in a serious condition, but from the obscurity of the symptoms, diagnosis was not made. On the fifth day he was again seized with severe pain. The fatal issue occurred on the eighth day. Autopsy showed purulent peritonitis from rupture of the bladder. Sugetinow believed the rupture involved only the mucous and muscular coats until the fifth day. Intraperitoneal rupture has been reported in cases of vesical cancer. This accident must be kept in mind in dealing with this condition as the life of the patient can be considereably prolonged by either permanent suprapubic or perineal drainage. Loumeau reports a case in which he shows that lithotrity in inexperienced hands may result in laceration of the bladder, and, on account of the non-repair of the accidental lesion, may be followed by leakage and fatal peritoneal infection. The same author mentions another case that is an example of mixed rupture, spontaneous in appearance but in reality produced by a trauma dating back thirty years, a hypo-

gastric traumatism received at that time resulted in contusion of the bladder with a prevesical hematoma followed by adhesions between the bladder and the abdominal wall. These adhesions under the influence of violent and repeated movements, finally broke away from the walls of the bladder at their point of implantation on the organ, from which resulted a tear in the bladder wall.

My own connection with this case was that of examining surgeon in the receiving ward.

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DRAINAGE OF THE PREVESICAL SPACE THROUGH THE PERINEUM IN SUPRAPUBIC CYSTOTOMY.*

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SUPRAPUBIC cystotomy admittedly affords the best access for intravesical operations; and when primary union of the incision is secured, leaves nothing to be desired.

Usually, primary union is not secured nor even attempted; and since drainage of the urine through a suprapubic tube—*i.e.*, against gravity—is a failure, leakage into the prevesical space commonly occurs in spite of the many ingenious devices intended to avert it, including the purse-string suture and siphon drainage. Stagnation of urine in this space invites infection, sepsis, pneumonia, and compels prolonged confinement to bed. Hence the mortality of the suprapubic is in elderly patients distinctly greater than that of perineal incisions for the same purpose, notably prostatectomy.

In spite of this greater mortality, suprapubic has largely superseded perineal prostatectomy in Europe, because the latter operation, by transforming the perineum into cicatricial tissue, entails so many distressing sequelæ—perineal and rectal fistulæ (in 8 per cent. of 2,000 cases), permanent incontinence of urine (3 per cent.), cicatricial contraction of the prostatic urethra, besides impotence, epididymitis and other minor ailments.

Stagnation of urine and tissue fluids in the loose prevesical tissues can be prevented in two ways: (1) By abolishing and (2) by effectively draining these tissues. Abolition of loose tissues is secured by making the operation in two stages, five days apart; when this is done under nitrous oxid anæsthesia the risks are minimized.

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* Read before the Chicago Urological Society, October 25, 1906.

The obvious objections to this method are avoided by the other plan, which, so far as I can learn, has not yet been recorded nor practised. This consists in drainage of the prevesical space into the perineum—at the bottom instead of the top—with complete closure of the suprapubic wound. The procedure is this: When the operator is ready to close the wound, the membranous urethra is opened on a grooved staff, the gorget introduced and staff withdrawn; a small trocar and canula is passed from above along the anterior surface of the bladder and prostate into the groove of the gorget. The trocar being withdrawn, a few silkworm strands are threaded through the canula and along the gorget out through the perineal wound (a small perforated rubber drain may be attached and drawn through by the threads). A large, soft catheter with multiple perforations having been introduced into the bladder for perineal drainage, the suprapubic incision, bladder and abdominal wall are closed completely except where the threads protrude, the anterior bladder wall being anchored near the recti muscles. Urine which may leak through the bladder wound, and tissue fluids, find ready exit at the bottom of this space.

In nine of eleven cases in which I have made this operation the wound has been entirely healed within two weeks; in the remaining two—prostatectomies in which oozing blood was allowed to block the perineal drain—the wound was reopened for the insertion of a larger drain. Greater care in checking oozing with formalin gelatine, should prevent this mishap.

DRAINAGE OF PROSTATIC ABSCESSES THROUGH THE ISCHIO-RECTAL FOSSA.

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A MAN, aged 23, was admitted to Bellevue Hospital suffering from an abscess of the prostate. The abscess was felt by rectal examination as a tumor the size of a small hen's egg, situated in the median line and extending over to the left side. The patient gave no history of venereal infection, but said that he had been recently undergoing urethral instrumentation.

Operation.—In opening the abscess the approach to the prostate was by a lateral route which, being along natural planes of separation of the tissues through the ischio-rectal fossa and along the anterior pubic fibres of the levator ani, afforded easy access to the site of incising the tumor.

The accompanying figures, drawings over photographs of the dissections, illustrate the surgical anatomy of this method of lateral approach to the prostate for opening an abscess, and the steps of the operation. Drainage was made through the patient's left ischio-rectal fossa, though the illustrations show the anatomy of the right side.

Fig. 1 shows the line of the skin incision (*A*) projected upon the fascia forming the floor of the ischio-rectal fossa, and its relations to the tuberosity of the ischium, the external sphincter, and the gluteus maximus. There is here some distortion from the normal relation to the anal opening, owing to the relaxation of the sphincters in the dead subject. The incision starts at the fore part of the prominence of the tuberosity of the ischium at its inner aspect, which point is about on a transverse line passing through the anterior margin of the closed anal opening, and is carried diagonally backward and inward across the floor of

the ischio-rectal fossa in the space between the fibres of the external sphincter and the gluteus maximus muscles. The front portion of this incision, lying just internal to the tuberosity of the ischium, is deepened until it extends about one-half to three-quarters of an inch above the level of the extremity of the tuberosity, after which the finger introduced into the wound and passed along the smooth obturator fascia (Fig. 2, *B*) covering the inner surface of the tuberosity, enters a distinct fascial compartment (Fig. 2).

Fig. 2 shows this fascial compartment which lies in the outer portion of the ischio-rectal fossa, opened up. Usually no vessels traverse its space. It is limited externally by the firm obturator fascia (*B*) which is the guide to its ready detection by the entering finger, as described above. The apex of the space passes a little forwards above a transversely elevated band of tissue (*C*) in its anterior wall. The contour of this elevated band conforms to the base of the triangular ligament and, lying along the latter, the transverse perineal vessels and nerves. The fascia at the apex of the compartment—*i.e.*, just above the transverse band and consequently above the base of the triangular ligament—is now carefully punctured in a forward direction (indicated by the arrow), after which the finger is pushed through the opening into a plane of cleavage above the triangular ligament along the anterior bundle of levator ani fibres (Fig. 3, *D*), which follows the pubic ramus.

Fig. 3 shows the plane of cleavage along the anterior levator ani fibres above the triangular ligament, which the finger enters and dilates through the incision at the apex of the fascial compartment. In the dissection from which this picture was made, the base of the triangular ligament (*E*—posterior layer) on the right side was cut transversely across at the fore part of the ridge of tissue (*C*), after having first severed from the ramus for a short distance in front of the fascial compartment the superficial fascia, and with it the origin of the transversus perinei muscle. The tissues of the urethral triangle in front of this dividing incision,

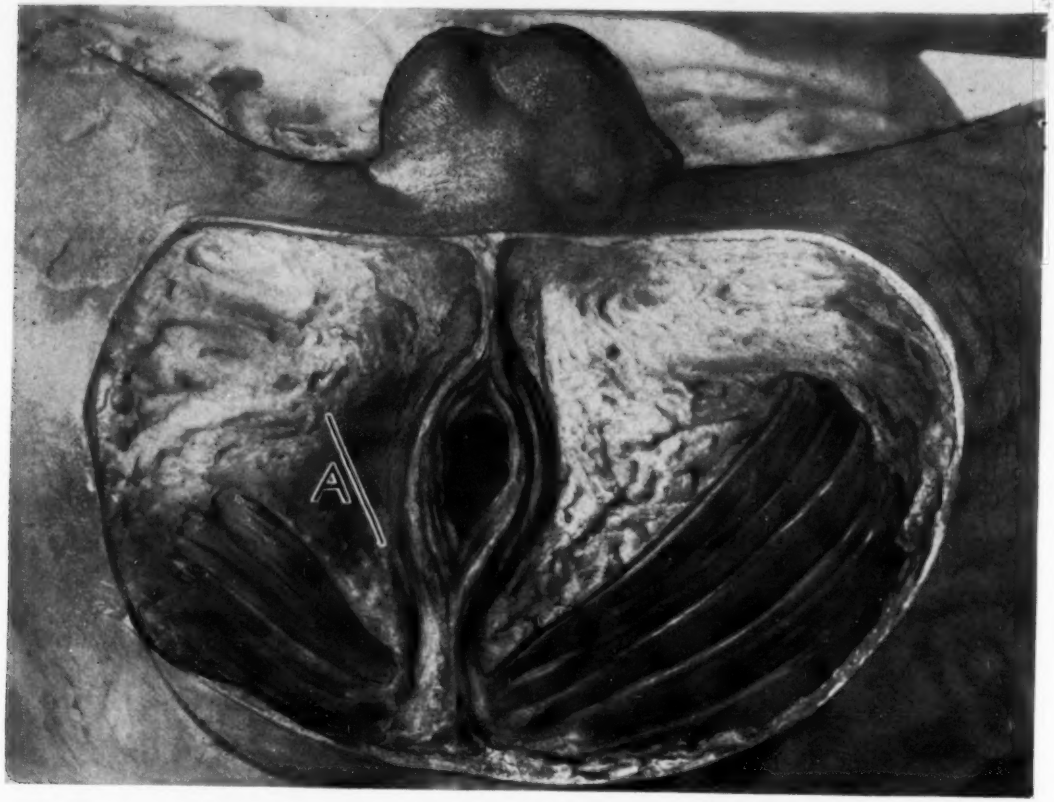

FIG. 1.—A line of skin incision projected upon the fascia forming the floor of the ischio-rectal fossa. It begins at the forepart of the prominence of the tuberosity of the ischium about on a transverse line passing through the anterior margin of the contracted anal opening, and passes backward and inward between the external sphincter and the gluteus maximus muscles.

FIG. 2 shows the fascial compartment in the outer part of the ischio-rectal fossa, limited externally by the firm obturator fascia (B), which is the guide in entering the compartment. The compartment was here laid open, instead of by the incision A, Fig. 1, by an angular incision, one arm of which ran along the inner margin of the tuberosity of the ischium, and the other parallel to, and a little in front of, the lower border of the gluteus maximus muscle. C, transversely elevated band of tissue in anterior wall of fascial compartment, containing transverse perineal vessels and nerves and the base of the triangular ligament. *The arrow* indicates the direction of the puncture at the apex of the fascial compartment and its situation above the level of the transversely elevated band or base of the triangular ligament.

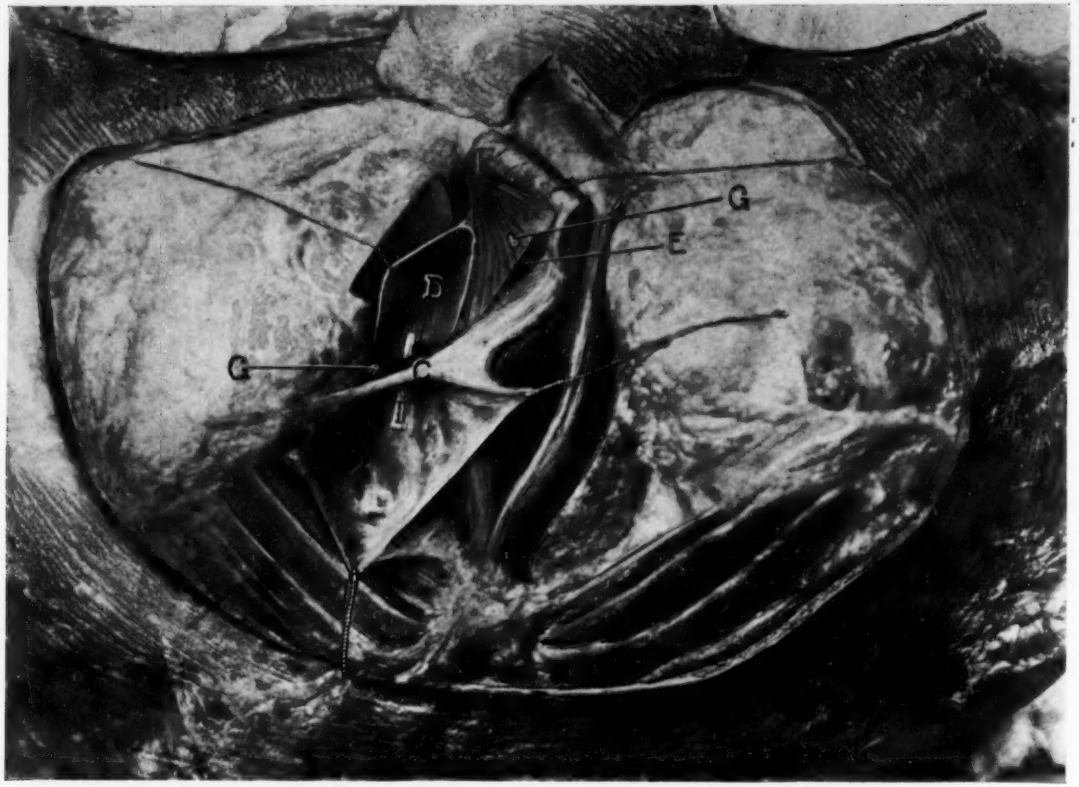

FIG. 3.—shows the plane of cleavage along the anterior levator and fibres (D) above the triangular ligament, opened up. The base of the triangular ligament (E, posterior layer) on the right side has been cut transversely across, and the structures of the urethral triangle anterior to this dividing incision, together with a longitudinal slice of the adjoining ramus (F), have been reflected over to the left. C, transverse band, containing margin of triangular ligament and transverse perineal vessels and nerves, left in situ. I, stick passed through the slit at apex of fascial compartment above the level of the transverse band. G, G, internal pudic artery.

FIG. 4.--Shows the anatomical structures that would lie between a prostatic abscess, bulging toward the rectum and laterally, and the finger introduced through the fascial compartment of the ischio-rectal fossa (in the course of the stick I) into the plane of cleavage along the anterior levator ani fibres above the triangular ligament. D D, anterior levator ani fibres which have been split apart to show immediately above them the recto-vesical fascia (H). This fascia has been cut transversely along the lateral margin of the prostate (K) together with the recto-urethralis muscle (L) and the fascia (M) lining the prerectal space. The prerectal space has been opened up by blunt tearing of the delicate connective tissue which normally maintains its obliteration, so that the rectum sags backward, and through the opening in the recto-urethralis muscle the situation of the base of the prostate (K) can be seen.

together with a longitudinal slice of the adjoining ramus (*F*), were then reflected over to the left, so as to expose the plane of cleavage above the triangular ligament to view. The bridge of tissue (*C*) left in situ, contained a small portion of the base of the triangular ligament, and the transverse perineal vessels and nerves. Above this bridge, through the slit at the apex of the fascial compartment, a stick (*I*) has been passed to show the course of the finger as it enters the dilatable area along the anterior fibres of the levator ani. The only possible danger to be guarded against when puncturing the apex of the fascial compartment, is that of injury to the internal pudic artery (*G*, *G*). This artery had to be severed in the dissection to permit the reflection of the tissues. It lies a little external to the site of making the puncture, being in juxtaposition to the puncture at a point just where it emerges from the fibrous compartment of the obturator fascia. Thence the artery passes forwards to enter the compartment of the triangular ligament, where it lies close to the ramus. It could only be injured by an outward cut, which should consequently be avoided.

Fig. 4 shows the relation of the prostate to the rectum and to the structures which would intervene between a bulging prostatic abscess and the finger which has been passed into and has dilated the plane of cleavage above the triangular ligament. The first of these intervening structures is the levator ani muscle (*D*, *D*) at its anteror aspect, the fibres of which have been split apart to show above them the next structure, which is the recto-vesical fascia (*H*) covering the side of the prostate (*K*, inferior aspect) and reflected down over the recto-urethralis muscle, to pass below between the external and internal sphincters of the anus. A transverse cut has been made in this fascia just below the edge of the prostate, to reach next the recto-urethralis muscle (*L*), which in turn has likewise been cut transversely across in the line of the incision in the fascia, being thus divided close to its origin from the side of the

prostate. Beneath the recto-urethralis muscle is the fascia (*M*) lining the prerectal space. In this dissection the prerectal space, normally no actual space at all, but, as it were, a collapsed fibrous sac located between the rectum behind and the bases of the bladder and prostate in front, and capable of easy dilatation by blunt force, has been opened up, so that the rectum sags backwards, and the locality within this space corresponding to the base of the prostate (*K*) is seen through the opening in the recto-urethralis muscle.

In the case now reported, after having dilated the plane of cleavage along the anterior levator ani fibres above the triangular ligament with the finger, the abscess could be felt in the bottom of the wound as a prominent rounded elastic tumor, and was readily incised by a narrow-bladed knife passed along the finger. The artery to the prostate enters near the postero-lateral corner of the organ and ought not to be injured by the incision. The branches of the middle hæmorrhoidal artery, when present, lie close to the rectal wall antero-laterally, and would be pushed backwards out of danger by the bulging of the abscess. After the pus was evacuated, the cavity was drained with a tube surrounded with gauze. The *bacteriological examination* of the pus showed the infection to have been due to the staphylococcus.

Course.—The drainage material was rapidly diminished in amount so as not to interfere with the contraction of the abscess cavity. The wound healed from the bottom. On the fourteenth day the wound sinus was one and a half inches in depth. On the fifteenth day the patient left the hospital voluntarily. The wound healed uneventfully, and the patient had a perfect recovery.

This operation is suggested for cases of prostatic abscess of the kind here described which have not ruptured into the urethra and present a tense elastic tumor bulging toward the rectum. It is not recommended for cases where the abscess has ruptured into the urethra, when the operation of perineal section with drainage of the bladder advised

by Alexander[1] would be undoubtedly indicated. Left to itself a prostatic abscess will open either into the urethra, into the rectum, or it will break laterally and then frequently burrow along the anterior levator ani fibres into the ischio-rectal fossa. Since the last mentioned route is a natural channel through which the pus of a prostatic abscess can discharge itself without liability of serious complication, it would seem not improper to employ this same route as the one of approach for the early evacuation of such an abscess. Alexander advises perineal section indiscriminately for all cases of prostatic abscess, with a view of avoiding sinus formation or recurrence that would follow improper drainage of the abscess cavity. The claim of the writer is that if one good result *can* be obtained by this method for the class of cases mentioned, in support of its employment for these cases, it can be said that the operation is certainly much simpler of performance than that of perineal section, the after-treatment does not require special surgical knowledge, the after-discomfort to the patient is less, the bladder is not exposed to any danger of infection, and there is no subsequent urinary fistula to be treated, all of which facts would certainly appear as advantages in offering this method for trial, over the more radical operation, even though the latter be capable of producing an undoubted good final result.

As compared with simple drainage of a prostatic abscess by the anterior perineal incision, going between the bowel and the urethral triangle, the possibility of doing which by a definite anatomical dissection has been shown in 1902 by Gosset and Proust[2], and in 1904 by the writer,[3] drainage by this diagonal lateral incision and approach through the ischio-rectal fossa would seem to have the preference for the following reasons: The route is direct and easily accessible; no danger of injuring the rectum or urethra; the scar is smaller and laterally situated.

The simplicity of this operation should at least appeal, if only as a temporary measure of relief, to the general

practitioner who may be called upon to relieve one of these conditions under surroundings unfavorable for performing more than the simplest operative measure.

For the proper treatment to obtain healing of an abscess of the prostate opened by the lateral route, the writer would suggest the following requisites: (*a*) The free and dependent drainage of the abscess cavity through a wide opening in the abscess wall; (*b*) the early removal of the drainage from the deep portion of the wound, to permit collapse of the bottom of the sinus; and (*c*) particularly the avoidance of irritating disinfectants, such as bichloride of mercury, carbolic acid, and potassium permanganate, for the syringing of the sinus. Peroxide of hydrogen, which is the best antiseptic solution for cleansing an abscess cavity, or a solution of chinosol[4] 1 in 500, or simple boiled water alone should be used, none of which agents destroy tissue. As the deep part of the wound contracts, in order to insure its closure the drainage tube should reach only to within about two inches of the bottom, and should be progressively shortened as deep obliteration of the track takes place. As the discharge lessens and the track begins to granulate healthily, the closure of any sinus seems to be favored by suspending syringing altogether.

Lateral incisions for approach to the prostate have been reported by Dittel[5] in 1890, and by Delagénière[6] in 1900.

Dittel's method was employed solely for the removal of a lateral lobe of the prostate. He made his incision from the tip of the coccyx toward the anal margin in the median line, then around the external sphincter, ending at the perineal raphe in front. Delagénière recommended his method especially for hypertrophy of the prostate, also for abscess and malignant disease. His incision, which he called the longitudinal or parasacral incision, began at the base of the scrotum, descended in the median line to within two centimetres of the anal opening, turned thence in a semicircle around the anus, then followed the median line again to

the tip of the coccyx, and finally passed along the lateral margin of this bone.

Both Dittel and Delagénière are indefinite as regards the surgical anatomy of their operations. They both insert a sound into the urethra to prevent its injury.

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SILVERIZED CATGUT.

A STUDY OF THE METHOD OF CRÉDÉ FOR STERILIZING CATGUT WITHOUT HEAT.

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As is well known, Professor Crédé, of Dresden, has advocated the use of colloidal silver and silver salts in the treatment of various forms of infection, and also as a means for preventing infection. Many of these preparations are very efficient as antiseptic agents and are practically harmless. This is especially true of collargolum, which can be used intravenously in doses of 5 to 10 c.c. (1.25 to 2.50 drachms) of a 1 per cent. solution.

By treating catgut with colloidal silver the catgut itself is not only made sterile, but it becomes impregnated with an efficient and innocuous antiseptic agent which exercises a local inhibiting influence upon the growth of any bacteria which may have been introduced in the wound from any cause.

My personal observation during a visit paid to the clinic of Professor Crédé, substantiated the claims made for the advantage of such catgut for ligatures and sutures. I found that Professor Crédé used catgut sutures almost exclusively; that there was no post-operative infection attributable to the inefficient sterilization of the catgut, and, that post-operative infections from any cause were very rare. Crédé's treatment of the catgut was to impregnate it with colloidal silver, and preserve it dry; then, several days before use, it was placed in alcohol.

In the spring of 1905, while engaged in laboratory work in connection with the service of Dr. L. S. Pilcher in the Methodist Episcopal Hospital in Brooklyn, I undertook, through his advice and by his direction, to test specimens of catgut prepared in a manner similar to that of Crédé. The

tests covered a period of several months, and the present paper records the results of these observations.

Collargolum is simply metallic silver prepared in such a manner that it is soluble in water, but not diffusible through animal membrane. It was first described by Lee, in 1889, but was first prepared in a form practicable for use by Professor Crédé several years later. It occurs as simple, hard, brittle, bluish-black, scale-like pieces, which are soluble in water to the extent of 1 to 20; the solution being dark olive-brown in color and remaining stable for months.

No silver particles can be distinguished in the solution when observed under the highest powers of the microscope. It is not diffusible, and, in contradistinction to other inorganic bodies, the addition of albumin to collargolum prevents or delays the precipitation of acids and salts. A sufficient amount of albumin is therefore added to the collargolum during its manufacture to prevent its precipitation under ordinary conditions. Collargolum is unaffected by boiling; but boiling is quite unnecessary, as the solution is itself antiseptic.

"Collargolum may be introduced into the system intravenously, subcutaneously, endermically, or by mouth or rectum. Introduced intravenously it circulates in the blood for about eight to ten hours, and is then deposited in the organs or eliminated. It appears to be excreted through the intestines and kidneys, and never produces argyria. The elimination of silver is greatest during the first days. It can be detected after a week, and only after a month disappears entirely.

"No matter by what method the silver is introduced into the body, it exerts a markedly antiseptic action, and directly combats septic infection, whether due to staphylococci, streptococci, or similar bacteria, alone or combined with the bacteria of decomposition, which intensify the action of the pyogenic bacteria."—"Colloidal Metals in Medicine." Brochure. J. L. Berger, Berlin, 1904.

Collargolum therefore fills a very important place in the combatting of septic disease, and its marked usefulness is

attested by a large and growing literature both German and foreign.

Our first test was directed to determine whether there would be any advantage in soaking the catgut in ether before immersing it in the collargolum solution. A strand of catgut was divided in half and each half was wound on a glass spool; one spool was placed in ether for five days, the other was kept dry. Both were then immersed in a 1 per cent. solution of collargolum. Two days later, a section was removed from each spool; but neither was thoroughly impregnated with the silver, as shown by the failure to darken in the centre on exposure to light. The corollary to this fact was revealed by later experiments: namely, that two days' immersion in the silver solution was insufficient to sterilize the catgut in all cases. Sections removed four days later were found to be thoroughly impregnated. A couple of strands removed at this time were left lying on the laboratory desk, exposed to the dust and air, until used for subsequent experiments some weeks later. On the twelfth day the spools were removed from the collargolum solution, washed in running water, and placed in a covered glass dish. This was clean but not sterilized. No precaution was taken in handling the spools to prevent contamination.

This test failed to reveal any advantage to be derived from the preliminary soaking in ether. The non-etherized catgut absorbed the silver solution quite as readily as the other; and in all subsequent tests the preliminary immersion in ether was omitted.

It was eleven days before any further tests were begun. On that day several short strands of catgut were removed from the non-etherized spool without any aseptic precautions. Two were placed in two bouillon tubes, and three in an agar tube. The spool was then placed in 95 per cent. alcohol. After twenty minutes, a piece was removed from the spool under aseptic precautions, washed in water, and divided into five parts; three of these were placed in three bouillon tubes; and the other two in an agar tube. At the same time one of

the pieces that had been left lying on the desk exposed to the dust and air, but likewise to the direct sunlight, was cut in two, and one-half placed in a bouillon tube and the other half in an agar tube. All were then placed in the incubator at 37°. Of the nine tubes thus prepared, eight showed no sign of growth at the end of a month. One bouillon tube containing a section which had been removed without any aseptic precautions, showed slight growth at the end of the second day.

The spool from which the preceding tests were made, was allowed to remain in the 95 per cent. alcohol for two weeks. It was then removed and left lying on the laboratory desk. On the next day six short strands were cut off without aseptic precautions and placed in an agar tube. On the following day one strand showed growth at the tip end. Growth continued slowly from this point during the succeeding two weeks that the culture was observed. The other five strands remained sterile.

After lying on the desk for three days, the spool was soaked in alcohol for an hour and dried in the air for fifteen minutes. Sections were then placed in a bouillon tube and in an agar tube under aseptic precautions. Both tubes thus prepared remained sterile at the end of ten days.

For the purpose of making comparative tests, a spool of sterilized catgut was obtained from the operating room, and under all aseptic precautions sections were cut off and placed in three bouillon tubes and in an agar tube. Two short pieces were then cut off the same spool, drawn through unsterilized hands, and placed in two bouillon tubes. Sections of non-sterilized catgut were likewise placed in three bouillon and in an agar tube. On this same morning, Dr. L. S. Pilcher cut off two pieces from a strand of plain sterilized catgut, and two from a strand of chromic catgut that he was using during an operation, and dropped these into four culture tubes, two of bouillon and two of agar. A piece of silverized catgut which had been lying on the desk for five weeks was likewise dropped into a bouillon tube and all fifteen tubes placed in the incubator.

On the following day all three tubes containing the non-sterilized catgut showed heavy growth; so also did the two tubes containing the sterilized catgut that had been handled. Two of the tubes containing supposedly sterile catgut showed moderately heavy growth, the other two slight growth. The two agar tubes containing the sterilized catgut and the one containing non-sterilized catgut also showed beginning growth. Both the bouillon and agar tubes containing the chromicized catgut failed to show evidence of growth, and this remained true a week later. The tube which contained the silverized strand failed to show growth on the following day; but on the fourth day there was slight growth. Evidently the amount of silver present was insufficient to prevent all growth after such prolonged exposure to contamination.

Convinced by these tests that the silver solution was not only capable of sterilizing catgut, but also that it was capable of exerting a very marked inhibitory effect on the growth of bacteria adhering to the surface as a result of subsequent infection, our next tests were directed to the determination of the length of time necessary to ensure complete sterilization.

Before describing these experiments, a couple of points should be noted in reference to the preceding tests. All the silverized strands tested proved to be sterile except three. Of these three, one had been exposed to dust and air for weeks; and the other two had been cut off the sterilized spool with unsterilized scissors. The single test made on the chromic catgut showed it to be sterile. The six tubes containing supposedly sterile catgut all showed growth on the succeeding day. The corollary to this fact was discovered in a severe case of infection following suture for ununited fracture, and investigation showed that the catgut used at the operation and for the tests was from the same lot. No detailed investigation was made of the nature of the infection in the catgut, but from stab gelatine cultures and microscopic examination we concluded that we had present the staphylococcus aureus and albus, and an undetermined variety of bacillus.

During the succeeding weeks numerous tests of chromic

and plain sterilized catgut were made. The results were practically the same as the preceding. The chromic catgut appeared to be sterile in all cases; the plain sterilized was frequently infected. The plain sterilized catgut has been prepared by boiling in alcohol after the method of Fowler.

On May 27, strands of heavy, medium, and fine catgut were wound on separate spools and placed in a 2 per cent. collargolum solution. They were removed at varying intervals and tested as follows:

(1) May 29. Sections were removed from each spool, washed in running water from the boiler, immersed in alcohol for five minutes, dried in the air, and dropped into tubes of bouillon. On the next day no growth was apparent. On the following day there was growth in the tube containing the medium catgut. On the second day thereafter there was heavy growth in this same tube. At the end of two weeks there was no growth observable in either of the other two tubes.

(2) Sections removed from the collargolum at the same time, and treated in the same manner as the preceding, except that they were left in the alcohol twenty hours. At the end of the second day, the tube containing the medium catgut showed slight growth. The other two tubes remained clear at the end of two weeks.

(3) May 30. Sections of catgut were removed from each spool, washed in hot tap water and placed in alcohol.

(4) May 31. Sections removed from the spools and treated as the preceding.

(5) June 2. Sections prepared as the preceding.

Owing to a delay in obtaining culture media, it was ten days before these sections were placed in bouillon tubes. But as cold alcohol is insufficient to sterilize catgut, this delay could not have materially modified the result. All the tubes thus prepared remained sterile at the end of two weeks.

(6) June 5. Sections were removed from the spool of medium catgut, washed in tap water, and left in the covered glass dish for a week. They were then handled by Dr. Pilcher, without his having sterilized his hands, and were then placed

in three bouillon tubes. On the second day there was slight cloudiness in one of the tubes; but it did not increase. The silver present had apparently checked the further growth. At the end of two weeks all three tubes were perfectly clear.

(7) June 5. A strand of sterilized catgut was obtained from the operating room and handled as the preceding. It was then divided into three pieces and these were placed in three bouillon tubes. On the third day thereafter, two tubes had become cloudy, and the third contained a flocculent precipitate. At the end of a week, growth had increased slightly in all. At the end of two weeks, two tubes were very cloudy; the third contained a heavy precipitate.

The results of these tests may be thus briefly summarized: Perfect sterilization was sometimes achieved after two days' immersion in the silver solution, and always after three days' immersion. Catgut thus prepared showed a very marked resistance to subsequent infection, and, likewise, a marked inhibitory influence upon the growth of bacteria introduced with it into the bouillon solutions. This inhibitory influence was much less marked in the agar tubes. To obtain it, a partial dissolving out of the silver appears necessary, and this is exactly what occurs both in the bouillon tubes and in the tissues.

Encouraged by the favorable outcome of these experiments, our next step was to employ silverized catgut at an operation.

Several spools of medium-sized catgut were placed in a 2 per cent. collargolum solution, and left for five days. They were then washed in sterile water, dried for a few minutes in the air, and then placed in 95 per cent. alcohol. A couple of days later, catgut from these spools was used as the ligature and suture material at an operation for removal of tubercular glands of the neck. Two agar and two bouillon tubes were prepared from short sections cut from ends remaining after tying the ligatures.

Recovery after the operation was prompt and uneventful. The wound showed no sign of irritation and healed by primary

intention. All four tubes containing the samples of catgut employed at the operation, remained sterile after the lapse of ten days.

During the next week, the silver catgut was only used in selected cases, mainly those involving superficial operations. Since then, in the service of Dr. Pilcher, it has entirely replaced the plain sterilized catgut, for all purposes for which the latter is commonly employed.

During the earlier portion of this period, the silver catgut was repeatedly tested, but always found sterile.

Numerous tests were made as to the most suitable strength of the collargolum solution, and as to whether the same solution could be used twice in succession. We found that after the first time, the silver became precipitated, so that it no longer impregnated the catgut quickly and evenly. It is therefore advisable to place the maximum amount of catgut in the minimum of solution, but it must be rolled upon the spools before being placed in the solution.

For a time it was noted that the catgut when removed from the spool was a trifle soft and hard to thread; whereas a few minutes later it would be hard and almost wiry. The cause of this was found to be an error in technic. The catgut as it comes out of the collargolum solution is quite as soft as after soaking in plain water. In order to dry it, it is necessary to expose it to the air until the silver is deposited as a metallic sheen. If placed in the alcohol too soon, this change does not occur, until it is once more exposed to the air as at operation.

It was my purpose to make a number of tests of the relative tensile strengths of plain sterilized, chromic, and silverized catgut; but my investigations were interrupted after only one test had been made. This test was as follows: Strands of chromic, silverized, and plain sterilized catgut of medium size were each divided into two pieces, marked A, and B. The ends of each piece were tied together separately, making six loops. The loops were then placed on spools, and the tensile strength noted. The result thus found is that of two strands,

or double that of one strand. In every case the knots were so placed that they did not receive the full force of the strain. The point at which A broke having been noted, the broken ends were tied, and the piece again tested. The point at which the strand broke having again been noted, the longer piece was again tied in a loop, placed in water for fifteen minutes, and again tested. The strands marked B were immersed in water for thirty minutes and then tested. The results may be summarized as follows:

CHROMIC.	SILVERIZED.
Aa broke at (knot) 19 pounds	Aa broke at.....20 pounds
Ab broke at.....22 pounds	Ab broke at.....20 pounds
Ac broke at.....18 pounds	Ac broke at.....16 pounds
B broke at.....14 pounds	B broke at.....13 pounds

PLAIN STERILIZED.

Aa broke at.....20 pounds
Ab broke at.....18 pounds
Ac broke at..... 9 pounds
B broke at..... 9 pounds

In other words, the silverized catgut appeared to be slightly stronger than the plain sterilized catgut, and slightly weaker than the chromic catgut. After immersion in water for fifteen minutes, the chromic catgut lost about 14 per cent., the silver catgut 20 per cent., and the plain sterilized catgut about 50 per cent. of the tensile strength. After thirty minutes' immersion in water, the chromic catgut had lost 33 per cent., the silverized 35 per cent., and the plain catgut 50 per cent. of the original tensile strength.

Although this single test fails to prove anything, it nevertheless corroborates the clinical evidence which shows that the silverized catgut is but little if any inferior to the chromic catgut in tensile strength and resisting qualities, and is very markedly superior to plain sterilized catgut in both these qualities.

In the preparation of the catgut for use, the method employed is as follows: Four coils of catgut, each containing ten strands, are wound on four glass slabs, and placed in a jar

containing a 2 per cent. solution of collargolum. They remain in this about a week, the jars being shaken once or twice in the interval. The slabs are then removed, washed in sterile water until the excess of collargolum solution is removed, and placed in 95 per cent. alcohol for fifteen to thirty minutes. After this the separate strands are wound on separate spools, under aseptic precautions, and preserved in 95 per cent. alcohol until used. Four coils are employed as the unit, as they exactly fill the jar containing the collargolum solution; and as many jars are prepared at any one time as may be necessary.

[NOTE BY DR. PILCHER.—Since the demonstration by Dr. Blake of the reliable qualities of silver preparation in rendering catgut not only aseptic, but also to a certain degree antiseptic wherever buried in a tissue, it has been used in all cases in my operative work at the Seney Methodist Episcopal Hospital, amounting in number to more than 500 operations, and has continued to give me abundant satisfaction and to justify, clinically, all the expectations which the laboratory experiments of Dr. Blake had suggested.

During this period there has been a notable absence of infective accidents in an active general service which has included nearly every variety of operative interference. Silverized catgut has become established as a permanent factor in our operating-room methods.

The method of preparation is simple and reliable, and may be commended to a further trial by surgeons.

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NOTE ON GONORRHŒAL OSTEOMYELITIS.*

BY R. C. CUPLER, M.D.,
CHICAGO, ILL.

ROBERT G., 20 years of age, a healthy, athletic young man. His previous history is unimportant. March 4, 1905, he consulted with me concerning his recently acquired acute gonorrhœal urethritis. March 12, his posterior urethra became infected. He complained of a desire to micturate every few minutes. The straining to pass a few drops was accompanied with intense pain. Between these attacks he had sharp, lancinating pains through the deep urethra, extending up the rectum. He had painful erections without erotic incitation. Hematuria more frequent and of greater volume than I had ever seen. The right testicle became swollen. Constipation, headache, marked mental depression, loss of weight and appreciable fever were present. April 5, his left shoulder became severely painful. During the following days he had slight remissions from pain, always worse at night. He described this nocturnal pain as that of worms moving in the bone. Temperature 99 to 102, pulse 90 to 100, both fluctuating during the progress of the affection. April 9, the joint was now slightly swollen and motion was not very painful. Dr. F. J. Ehrman saw the patient on this date. The diagnosis of acute gonorrhœal arthritis was suggested. Paracentesis of the joint gave about 20 c.c. of fluid; cultures and smears from this showed gonococci; no other organism present.

This procedure gave the patient no relief from the agonizing pain. The following day I opened the joint. It contained a few c.c. of fluid, the head of the humerus had a cavity with necrotic bone. Smears from here showed a biscuit-shaped diplococci in the protoplasm of the leucocyte and negative to Gram's stain.

To recapitulate: The patient was in his fifth week of acute gonorrhœal urethritis; his swollen, congested, eroded urethral

* Read at a meeting of the Douglas Park Branch of the Chicago Medical Society, September 3, 1906.

mucous membrane afforded an ideal opportunity for the entrance of bacteria into the circulation. He had pain, directed to the upper end of the humerus, mainly nocturnal, boring, not relieved after the puncture or local treatment of the joint. Associated with an elevation of temperature, operation showed the roughened bone end of osteomyelitis. Relief followed only after bone curettage. Examination of the fluid and smears from the bone cavity gave biscuit-shaped diplococci which did not take the iodine stain. Therefore, I can come to no other conclusion than that the patient had osteomyelitis with the accompanying perforation into the joint and a secondary omarthritis, and that this infection was of gonorrhœal nature. I have failed to find another case reported.

Many organisms are capable of causing ostitis. Among those that are infrequent in the causation are B. influenza, B. coli communis and one reported by Litman. This organism, the B. halo septicum of Wyas, had its primary focus in a fœtid purulent bronchitis.

Lexter says, osteomyelitis is an embolic process. The emboli are usually clumps of bacteria alone. If large they enter the diaphyseal artery; if small they enter and plug the epiphyseal and metaphyseal arteries, causing a wedge shape infarct. The bone marrow contains microörganisms in most all acute infections. They may live there for years and produce no symptoms. Frankel found staphylococci in the bone marrow in 9 out of 13 cases of laryngeal diphtheria. Staphylococci is the most common secondary invader found in this disease. In scarlet fever streptococci were found in 9 out of 13 cases in the bone marrow. Da Costa reports the finding of gonococci in bone from resection of a joint for gonorrhœal arthritis.

Burkhardt says, acute osteomyelitis with accompanied suppurating arthritis is nearly always fatal. Three times more males than females have osteomyelitis. It is more common between 10 and 17 years. I believe the blood supply has its relation here. Sometimes pyogenic bacteria are carried from one end of the bone to the other without involvement of the intervening shaft.

This case demonstrates that gonorrhœal bone infection is of about the same in its toxic effect as gonorrhœal infection is elsewhere. The common staphylococci ostitis shows more pronounced constitutional and toxic symptoms. Bone infection should be considered in the diagnosis of painful gonorrhœal arthritis.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

Stated Meeting, October 10, 1906.

The President, Dr. George Woolsey, in the Chair.

STAB-WOUND OF THE KIDNEY.

Dr. Alexander B. Johnson presented a man, 39 years old, who was admitted to hospital on September 4, 1906. The history he gave was that he had just had a misunderstanding with some Italian laborers, one of whom had stabbed him in the right side of the back with the stilletto-like blade of an ordinary jack-knife.

Upon inspection, a stab-wound was found on the right side posteriorly, between the eleventh and twelfth ribs. The external wound did not bleed at all, and the patient, while he felt somewhat weak, complained of little or no pain. Thirty minutes after admission he passed, *per urethram*, three ounces of pure bright blood, which led to the diagnosis of a stab-wound involving the pelvis of the right kidney. On the following morning the kidney was exposed through a transverse incision made just below the border of the twelfth rib, disclosing a retroperitoneal hæmatoma of considerable size. Upon separating the kidney from its surrounding connections, a stab-wound of its posterior surface near the outer border was found. This was three-quarters of an inch in length, about the same size as the external wound. There were no indications that the pleural cavity was involved. The wound of the kidney, which bled freely, was closed by a single mattress suture of catgut, and a small drain was inserted. The hæmorrhage was checked immediately, and the urine cleared up with the exception of a few blood cells. When the kidney was exposed, a good-sized instrument could be passed entirely through the organ, and into the pelvis and ureter. The subsequent history of the case was uneventful, the man making a rapid and complete recovery.

SOME CONGENITAL ANOMALIES OF THE KIDNEY AND URETER.

Dr. Alexander B. Johnson read a paper with the above title.

Dr. George S. Huntington said that the subject presented by Dr. Johnson also carried a great deal of inherent interest from an anatomic point of view, and the speaker said that he had personally devoted much time to anomalies of the genito-urinary apparatus. He hardly felt able to enter into a discussion of the surgical aspects of the question, and would limit himself to a brief reference to the multiple blood supply of the kidney, especially its arterial branches, which depended on the migration of the kidney from the primary inception of the organ in the Wolffian body, which was exceedingly vascular, and upon the fact that in its course of development it could tap the mesonephron at any point. It was on this account that the superabundant and not infrequent anomalous blood supply of the kidney could be explained.

Dr. George E. Brewer said that in an examination of 150 subjects he had met with six cases of double ureter; in one of these the double ureters were complete and one of them communicated with a kidney segment which was the seat of tuberculous infiltration, while the remaining kidney substance and the opposite kidney were entirely free from disease. Dr. Bransford Lewis of St. Louis recently reported a very obstinate case of gonorrhœal infection of the kidney in which, upon cystoscopic examination, he found two ureteral orifices on one side. From one he obtained perfectly normal urine, while from the other the urine was purulent. The case proved to be one of gonorrhœal pyelitis affecting one segment of the kidney only.

Dr. Brewer said that in his investigations of vascular anomalies of the kidney he was surprised at the high percentage of cases in which such anomalies existed, and he recalled one instance in which there were five distinct renal arteries. In about thirty per cent. of the cases there was a separate and distinct, although comparatively small artery, leading to the anterior surface of the kidney.

Dr. George Woolsey said that the vascular anomalies that were not infrequently observed in the dissecting room were of interest alike to the anatomist and the surgeon. Both venous

and arterial anomalies were comparatively common. He referred to a case reported by Dr. Robert F. Weir a number of years ago, in which the life of the patient was endangered by a severe hæmorrhage from the accidental tearing of an anomalous renal vein. He also referred to a case similar to the one mentioned by Dr. Johnson, in which the patient had only a single kidney and died of uræmia after its removal.

Stated Meeting, October 24, 1906.

The President, Dr. George Woolsey, in the Chair.

SUTURE OF THE ILIOFEMORAL VEIN FOR STAB-WOUND.

Dr. Charles H. Peck presented a man, 21 years old, who was stabbed in the left groin with a large bread knife during a street altercation early in the morning of September 5, 1906. He was carried into a saloon, where the ambulance surgeon found him lying in a pool of blood and almost exsanguinated. Pad pressure was applied to the wound and he was hurried to the hospital. A saline infusion was given, during the course of which active venous bleeding recurred, which required continuous digital pressure over tight gauze packing in order to control it.

When the patient was taken to the operating room and anæsthetized, it was found that the stab-wound had severed Poupart's ligament over the line of the great vein. The wound was enlarged obliquely upward and outward, and vertically downward. The femoral vein was exposed below the wound, and a temporary ligature placed around it. The peritoneum of the iliac fossa was pushed upward until the external iliac vein was exposed above, and a similar ligature was passed around it. The deep circumflex iliac and deep epigastric veins were then ligated to control the hæmorrhage, which the temporary ligatures on the great vein had failed to check. Inspection showed that the wound in the vein was from one-half to two-thirds of an inch in length; it involved the anterior wall only, and was exactly in its longitudinal axis. It was directly beneath Poupart's ligament, chiefly in the terminal portion of the external iliac vein. The open mouths of the deep epigastric and

deep circumflex iliac could be seen through the wound. Digital pressure directly over the wound in the vein was maintained by the House Surgeon, Dr. Coerr, until the temporary ligatures on the main vein were in place, and the tributaries tied off.

The wound in the vein was then closed with a through-and-through continuous suture of No. 00 chromic gut, which checked the hæmorrhage completely. This was reinforced by another layer through sheath and overlying tissues, and the temporary ligatures were removed. Poupart's ligament and the deep muscles were sutured with chromic gut. The wound was then closed with catgut and silk, excepting at the lower angle, where a cigarette drain was placed. A long posterior splint was applied, and the limb elevated. The pulse was scarcely perceptible at one stage of the operation, and an infusion containing adrenalin was given on the table. Time of operation, fifty-six minutes. The patient rallied promptly from the shock, and there was no further hæmorrhage, and no venous congestion nor coldness or œdema of the limb at any time. The patient's temperature ranged below 100.4°, and his pulse between 80 and 90 for the first three days after the operation, and after that never rose above 99.8, excepting once, on the twelfth day, when it reached 100. The dressings were changed on the third day, when the wound appeared clean, and the drain was removed. At the next dressing, on the seventh day, rather extensive suppuration in the subcutaneous fat was discovered. This delayed the healing of the wound, but did not involve the deeper structures nor interfere with the healing of the wound in the vein. It was undoubtedly due to contamination of the original stab-wound, which it had been impossible to cleanse properly on account of the free bleeding. The limb was kept immobilized on a long splint for about two weeks. The patient was allowed out of bed on the twenty-fourth day, and left the hospital thirty days after the injury. The wound was practically healed, with the exception of a small granulating area.

PARTIAL GASTRECTOMY FOR CARCINOMA.

Dr. Chas. H. Peck presented a man, 66 years old, who was referred to him by Dr. Walter A. Bastedo, and was operated on at Roosevelt Hospital on July 13, 1906. He gave a history of stomach trouble dating back more than five years, with gradu-

ally increasing loss of flesh and strength, and vomiting, especially for the past two or three years. A mass could be felt in the region of the pylorus, and stomach peristalsis was visible through the skin.

Under ether anæsthesia, a vertical incision, five inches long, was made three-quarters of an inch to the right of the median line. About one-third of the stomach was occupied by an indurated mass, the center of which was on the anterior wall, two or three inches to the left of the pylorus. The lumen of the stomach was much constricted at this point, scarcely admitting the little finger through the rigid walled orifice. The pylorus itself was not involved. The stomach to the left of the obstruction was dilated, and its muscular coat much hypertrophied. The mass was not adherent to the surrounding structures, but the glands at both curvatures were enlarged. The first portion of the duodenum was divided with the thermo-cautery between clamps, about one inch below the pylorus. The cut end of the distal portion was closed with a continuous suture of heavy catgut, through all its coats, before removing the clamp, and then inverted with a purse-string suture of heavy silk. The lesser omentum was ligated in segments, and divided near the liver; the gastric artery was ligated near the cardiac end of the stomach. The stomach was then turned to the left, and the greater omentum ligated in segments below the line of the glands, as far as the middle of the greater curvature. The gastro-epiploica sinistra was then ligated, and the stomach divided between two long clamps, the excised portion including all of the lesser and about one-half of the greater curvature. The cut end of the stomach was closed with a heavy catgut lock-stitch suture before removal of the clamp. This was buried by a continuous catgut Lembert suture, and a third tier, of heavy silk, was placed in the same manner. A posterior gastroenterostomy was then performed with a Murphy button, Weir-flange, protected by interrupted silk Lembert stitches. The anastomosis was made in the first three inches of the jejunum. The edges of the slit in the transverse mesocolon were attached to the stomach by a few catgut stitches. A cigarette drain was inserted to the stump of the duodenum, and the abdominal wall closed by layers with catgut, chromic gut, silk-worm gut and silk. Time of operation, one hour and a quarter. The patient rallied nicely

from shock. A low rectal saline irrigation was given every six hours. Small quantities of sterile water were given by the mouth after twelve hours, and peptonized milk on the third day. There was no vomiting after the operation, and scarcely any nausea. The temperature barely reached 100° after the second day, and the pulse-rate was slightly above the normal. The patient's convalescence was uneventful. The button was never recovered in the stools, but as an X-ray picture taken before he left the hospital was negative, and he has had no symptoms suggesting its retention, its passage was undoubtedly overlooked. He was allowed out of bed on the twelfth day, and left the hospital eight days later. He was then eating a variety of solid food without discomfort. He has had no nausea or vomiting since the operation, and no distress after eating. He has gained about 30 pounds in weight since the operation.

The pathological report of the specimen was carcinoma, probably developing on the base of an old ulcer.

Dr. Willy Meyer, in speaking of the methods of securing the cut end of the duodenum in cases where the carcinoma involves the greater part of the superior horizontal portion of the same, referred to the following procedure, which he had applied in three of his cases, with excellent results: After the division and closure of the duodenum by the usual method, he considered it very wise, as an additional precaution, to stitch the head of the pancreas over it by a few interrupted sutures. If an omental flap can be drawn on top, one is still more secured against leakage from the stump. Under such conditions the insertion of a cigarette drain is superfluous. He has always closed the abdomen in his cases without drainage.

Dr. Meyer did not find his method mentioned in the extended discussion which recently appeared in the *Centralblatt für Chirurgie* on this subject or elsewhere in literature and therefore thought it worth while to mention it here.

Dr. Fred. Kammerer said he had followed this method of re-enforcing the sutured end of the duodenum mentioned by Dr. Meyer in two cases, quite a number of years ago. Both cases had done well and leakage from the duodenum was prevented. No doubt this method had suggested itself to other surgeons also.

PERICARDITIS TREATED BY DRAINAGE.

Dr. Otto G. T. Kiliani presented a man of 22 who was admitted to the German Hospital in 1901 for an attack of acute articular rheumatism, complicated by endo- and pericarditis. There was a large pericardial effusion which at one time became so threatening that it required immediate incision of the pericardium. Drainage of the pericardial sac was continued for seven days, after which the oozing ceased. Immediately upon incision, the patient, who had been practically moribund, showed signs of improvement, and his further recovery was uneventful. He had remained well up to the present time, a period of about five years.

BALL-VALVE TUMOR OF THE STOMACH.

Dr. Charles L. Gibson presented a man of 62, who was operated on at St. Luke's Hospital three weeks ago for the relief of gastric symptoms of some years duration, and consisting chiefly of a progressive loss of flesh and strength. An examination of the stomach contents, as well as the objective signs, led to a probable diagnosis of carcinoma.

Upon opening the stomach, a tumor as large as a good-sized cherry was found. It was attached to a pedicle about an inch and a half long, which sprang from just inside the pylorus. This tumor had apparently intermittently plugged the pylorus, thus giving rise to pyloric obstruction. The patient made a rapid recovery, and had since remained absolutely free from symptoms. The pathologist reported that the mass was polypoid in character.

Dr. Joseph A. Blake said that in a somewhat similar case upon which he operated about four years ago, the tumor proved to be an adenoma. It was pedunculated, and at times caused symptoms of obstruction by being swept into the pyloric orifice. The speaker thought that most of these polypoid growths of the stomach were adenomatous in character.

SARCOMA OF FEMUR TREATED BY MIXED TOXINS.

Dr. W. B. Coley showed the following cases of sarcoma of the femur treated with the mixed toxins of erysipelas and bacillus prodigiosus:

Case I.—E. R. F., 16 years old. *Giant-celled Sarcoma of*

the Lower End of the Femur, of central origin and rapid growth. The patient was admitted to Dr. Gibney's service at the Hospital for Ruptured and Crippled, on April 2, 1906, with a history that three months before she had first noticed pain on the inside of the left knee on walking. One month later she began to have slight tenderness in this region and a hard swelling appeared. This rapidly increased in size and very soon lameness developed. At the time of admission to the hospital, April 2, 1906, the patient's general condition was good and she was able to walk without apparatus, but had a decided limp. Just above the internal condyle of the left femur there was considerable enlargement, apparently of bony origin. The tumor did not connect with the cavity of the joint, but over the central portion deep palpation elicited a sense of fluctuation. The skin over the swelling was normal. Measurements of the thigh showed 1 inch atrophy of the affected side and 1 ¼ in. increase in size over the swelling just above the left knee.

The diagnosis in this case was difficult, and was settled by an exploratory operation by Drs. Gibney and Coley, on April 6, 1906. A 2 ½ in. incision over the swelling on the inside of the thigh showed a fluctuating tumor which, on aspiration, was found to contain bloody serum. An incision was made into the tumor, and a considerable quantity of blood and serum evacuated. The cavity itself was the size of a small egg and occupied the central portion of the femur. The tumor was exceedingly vascular and hæmorrhage was stopped by gauze packing. The blood count was practically normal.

The specimen was examined by Dr. Jeffries, pathologist of the hospital, who pronounced it giant-celled sarcoma. It was thought worth while to try the mixed toxins for a few weeks in the hope of saving the limb from amputation. The toxins were begun on April 9, and continued for about a month in doses sufficient to cause a moderate reaction.

At first there was decided improvement in the leg, as shown by a decrease of nearly 1 inch in size. Very soon thereafter, however, the toxins apparently lost their effect and the tumor began to rapidly increase in size. After consultation by Drs. Gibney, Bull and Coley, it was decided to amputate below the trochanter rather than at the hip joint. This was done on May 18, by Dr. Coley, 4 inches below the trochanter. The patient,

though suffering a good deal of shock, made a good recovery, the wound healing by primary union. The toxins were resumed as a prophylactic, on June 9, since which time she has had 32 injections into the other thigh and into the stump of the amputated leg.

Her weight on June 12, just after the beginning of the toxins, after amputation, was 77¾ pounds. She increased from ¼ to 2 pounds a week steadily and at the present time, October 24, weighs 91¾ lbs. The patient is in perfect health and there is no evidence of a return either in the stump or any other portion of the body.

CASE II.—S. D., female, 18 years old. *Mixed-celled Sarcoma of the Lower End of the Right Femur*, of central origin. No trauma. The patient was admitted to Dr. Gibney's service at the Hospital for Ruptured and Crippled on March 29, 1906, with the following history: One year ago she first noticed pain in the right knee, which was first treated for rheumatism. The pain continued until August, 1905, when a plaster of Paris splint was applied at St. Luke's Hospital, the condition being at that time regarded as of tuberculous origin. The treatment was continued for about seven months, the splint having been removed six weeks before she entered the Hospital for Ruptured and Crippled. The last two months she had been confined to bed and was very much emaciated and extremely weak. The right knee presented a fusiform swelling just above the joint. Measurements (just above the joint) showed a circumference of 15 ins. on the right side, 11¼ on the left. The knee itself was acutely tender and any motion painful. X-ray photograph showed the lower 6 inches of the femur nearly twice the normal thickness. The clinical condition seemed clearly tubercular osteitis and Dr. Gibney decided to excise the joint. A semilunar incision was made through the ligamentous patella. The joint when exposed was found in perfectly healthy condition, while the femur above the joint was much thickened and presented three softened, purplish areas. These softened areas were curetted and a large quantity of disorganized cheesy material removed. The lower end of the femur was almost entirely disorganized, shaft and condyles being connected only by three narrow bridges of bone. The material removed closely resembled that of tubercular tissue, but the microscopical report stated

it to be mixed-celled sarcoma. The blood count showed: Red cells, 3,360,000; hæmoglobin, 85 per cent.

After the diagnosis of sarcoma had been established, the patient was referred to Dr. Coley by Dr. Gibney for amputation. This was done 4 inches below the trochanter, on April 7, 1906. The patient suffered little shock and made an uninterrupted recovery, the wound healing by primary union. She was put upon the mixed toxins on April 26 and the injections were given every other day. The patient showed a very rapid increase in weight, rising from 69 pounds on June 12 to 92 pounds on October 24. In August both patients were sent to the country for two weeks during which time the toxins were remitted. Both patients will leave the hospital to-morrow and the toxins will be discontinued for a few weeks at least.

These cases, of course, are entirely too recent to be claimed as permanent results and they were shown by Dr. Coley for the purpose of illustrating his recent change of view as to the proper method of treating sarcoma of the femur. Up to two or three years ago he strongly believed in amputation at the hip joint for this condition. In six of eight hip-joint amputations which he performed for sarcoma without mortality, the patients showed no permanent recovery. Five had a recurrence within six months of the operation and the sixth case could not be traced.

Of 68 cases collected from the literature by Butlin, in which hip-joint or high amputation was done for sarcoma of the femur, only one patient is known to have remained well over three years.

Dr. Coley stated that he had been able to find seven cases of sarcoma of the femur in this country in which the patient has lived beyond three years. In three of these seven cases success was undoubtedly due to the mixed toxins of erysipelas and bacillus prodigiosus. In a fourth case, an osteosarcoma of the femur, in which hip-joint or high amputation was done by Dr. Bull at the New York Hospital, 16 years ago, a very severe streptococcic infection of the stump followed the amputation. The patient recovered, and was well when last heard from, sixteen years later. In this case there is reason to believe that the infection had much to do with preventing a recurrence. In one case the sarcoma was situated in the upper portion of the femur, causing spontaneous fracture. The disease was so far advanced that, in the opinion of Dr. Gerster of Mt. Sinai Hospital,

there was no hope from hip-joint amputation and the patient was sent to the Montefiore Home for Incurables. He received prolonged treatment with the mixed toxins with the result that the tumor entirely disappeared and the bone re-united. The patient was in perfect health more than four years after treatment. In this case the microscopical examination, made by Dr. Mandlebaum, pathologist of the Mt. Sinai Hospital, and confirmed by Prof. J. N. Prudden of Columbia University, showed the growth to be giant-celled sarcoma.

CASE III.—Dr. Coley then showed a case of extensive *round-celled sarcoma of the left femur*, in which he had strongly advised hip-joint amputation in February, 1902, but neither the patient nor his family would consent to the sacrifice of the limb. The patient was then put upon the X-ray treatment from February until December, and while there was unmistakeable decrease in the size of the tumor of the femur, extensive metastases developed in the pectoral and lumbar regions in December 1902. A highly vascular mass developed under the left pectoral muscle, the size of a hand, which was partially removed by operation. The tumor in the lumbar region extended from the anterior superior spine up to the ribs, apparently of about the size of a child's head. The patient was then put upon the mixed toxins of erysipelas and the treatment was continued with intervals of rest, for the greater part of the next year. In a few weeks the lumbar tumor softened and became necrotic. An opening was made posteriorly and large masses of tumor material were drained away. At the present time there is no evidence of any sarcoma either in the lumbar or pectoral region and subsequent curettings have shown no sarcomatous elements in the femur. There still remains a chronic thickening of the femur, which has not, however, increased in nearly four years. The patient's general health is good.

The results in these six patients, together with those previously referred to, have led Dr. Coley to believe that the most rational treatment of sarcoma of the femur at the present time, when situated in the usual locality, namely, the lower end, is a brief preliminary trial with the toxins. If no marked improvement is evident at the end of a month, amputation below the trochanter should then be done, leaving sufficient stump to enable the patient to comfortably wear a false leg; followed by

prolonged use of the toxins immediately after wound healing, in the hope of preventing a recurrence.

Dr. Coley finally showed a fourth patient, with inoperable *round-celled sarcoma of the spine*, well nearly five years after treatment with the toxins.

Case IV.—D. G., male, 20 years old. Diagnosis confirmed by Dr. H. Brooks, pathologist of the Bellevue Hospital. The tumor was of enormous size, involving the lower dorsal and upper lumbar vertebræ. The patient had lost about fifty pounds in weight, and there was so much pressure upon the spinal cord that there was total paralysis of the lower extremities, bladder and rectum, and he was so weak that he was unable to turn over in bed. Seen in consultation with Dr. V. P. Gibney, of the Montefiore Home, in February, 1902. The mixed toxins of erysipelas and bacillus prodigiosus were begun and continued by the house staff under Dr. Coley's direction; daily injections were given up to the following May, and severe reactions, temperature of 103° to 104°, followed most of the injections. Patient began to show improvement, local as well as general, almost at once. By September he was able to get out on crutches. In November he was shown before the New York Surgical Society by Dr. John Rogers. At that time he had regained nearly his normal weight and got about very well with the aid of a cane. In February, 1903, one year after treatment, he was able to walk perfectly well without support of any kind, and his general health had become perfect. He was able to resume his former occupation.

Dr. Coley stated that he considered this to be the most remarkable result ever obtained from the use of the toxins. Fortunately, there can be no doubt as to the diagnosis, since the tumor was not only examined by well-known pathologists,but specimens of the tumor have been preserved. He has shown this patient before various medical societies the past two years. The patient remains in perfect health, nearly five years after treatment.

Dr. John Rogers said that one of the patients shown by Dr. Coley, the young man with the tumor on the back, had been under his care for several months. The growth was a massive one, involving the region now occupied by the scar, and showed every clinical evidence of sarcoma. The disappearance of the growth under the use of the mixed toxins was certainly very

remarkable. The speaker asked Dr. Coley what percentage of recoveries in sarcoma he had met with by the use of the mixed toxins.

Dr. Coley said that he could not answer Dr. Roger's question accurately without referring to his records. Furthermore, it would depend somewhat on the type of sarcoma. Originally, he was inclined to believe that the best results from the use of the toxins were observed in sarcoma of the spindle-celled variety, and very poor in the round-celled type. In recent years, however, he had been obliged to change his opinion in that respect, as many cases of round-celled sarcoma had been successfully treated by the toxins. Speaking offhand, he could positively say that he had observed from ten to fifteen per cent. of permanent cures following the use of the toxins, and in that connection, the fact should not be lost sight of that he only recommended the treatment in hopeless cases that were inoperable, with this one exception, namely, in sarcoma of the extremities, where an amputation of the limb would otherwise be imperative. In such cases he believed it justifiable to try the toxins for three or four weeks before sacrificing the limb. Up to the present time Dr Coley had collected 12 cases (four personal and eight cases of other men) in which the arm or leg had been saved and eight of these patients were alive and well more than three years afterwards.

Dr. Alexander B. Johnson said he had under his observation a woman, about 35 years old, who had suffered from recurrent sarcomatous growths in various regions of the body. According to her history, her first sarcoma appeared when she was about a year old, and since that time she had submitted to at least fifteen operations for the removal of these growths. Personally, Dr Johnson said, he had operated on her four times, and he knew of several other surgeons who had operated on her three, four or five times. The regions involved have been the breast, the lumbar and gluteal regions, the groin, etc. At the present time she had a sarcomatous mass in the abdomen, which he had found it impossible to thoroughly remove in spite of a very far-reaching dissection. He asked Dr Coley whether, in his opinion, the mixed toxins were indicated in such a case.

Dr. Coley replied that under ordinary circumstances the use of the toxins would not be indicated under such conditions.

Still, he recalled cases equally hopeless, apparently, which had recovered under their use. The treatment required a thorough trial in order to prove or disprove its efficacy. In some cases it effected a marvelous recovery, while in others it was useless. In those cases where improvement occurred, it was apparently due to the systemic effect of the toxins, and not to their local action. In a case of extensive cancerous involvement of the mesentery which was referred to him by Dr. Willy Meyer about twelve years ago, the patient had recovered entirely under the use of the toxins. He had since remained well, and had recently married. In the spinal case he had shown, the patient had received no treatment since 1902.

EPIDURAL HÆMORRHAGE.

DR. ALEXANDER B. JOHNSON presented a boy, 19 years old, a native of Austria, and a tailor by occupation.

His past history was that he had suffered from occasional frontal headaches, which sometimes incapacitated him for work for half a day at a time. It was alleged by his friends that his mouth had always been drawn to the right, and that the left cheek was flattened, even when at rest. There was no history of epilepsy nor of venereal disease. The boy's habits were good.

On the morning of September 27, 1906, at 10 o'clock, he was knocked to the ground from a low wagon. He was able, unassisted, he said, to reach his home, a few blocks away, and walked up two flights of stairs. He at once complained of headache, and laid down. An hour later he vomited some food and a little blood, at the same time losing consciousness, and remaining in that state until six P. M. He vomited every time he turned his head, but there was no further vomiting of blood. There was no bleeding from the mouth, throat or ears. At six P. M. he recovered consciousness, and remained conscious for four hours, during which interval he vomited several times. An ice-bag applied to the head gave no relief to the headache. Leeches applied behind both ears made him feel weaker, but relieved the headache slightly. At this time he said he could not hear from the right ear. At ten P. M. he again became unconscious and continued to vomit on moving his head.

The following morning he was stuporous, but could be aroused; he would obey directions and even respond to ques-

tions at times. He still complained of headache, which was general in character, but most severe above the right mastoid region. He said it hurt him to see with the right eye and that there was still loss of hearing on the right side. He complained of no pain, save that in the head. The vomiting persisted. His friends state that his mouth was drawn to the right, but no more so than before the accident; that he was able to frown on both sides, to close both eyes tightly, and to move all his extremities. He had occasional slight twitchings, general in character.

The patient was brought to the New York Hospital in a carriage at 10.30 A. M. on September 28. Upon admission, he was stuporous, and could be roused with difficulty sufficiently to do simple things, such as opening the eyes or protrude the tongue, or briefly reply to questions. His eyes were closed; his expression apathetic, when not disturbed, yet he was very irritable, resenting any examination by turning about. The head showed no evidence of any injury. There was tenderness to percussion in the posterior temporal and mastoid regions on the right side; no change in the percussion note. The mouth was drawn to the right side; the left side of the mouth and left cheek were flaccid; the tongue was slightly coated and deviated a trifle to the left. No bleeding from the mouth, nose or ears. The forehead, in frowning, wrinkled only on the right side. Both eyes could be tightly closed, the right more so than the left. The right pupil was somewhat dilated, and failed to react to light. The opposite pupil reacted normally. There was no subconjunctival ecchymosis. On account of the patient's condition, it was impossible to test his sight.

Heart normal; pulse, 64, regular, slight increase in tension. Lungs and abdominal organs negative. The patient at times moved the extremities, and the right hand was occasionally carried behind the right ear, especially after pressure over that region. During most of the time the extremities were limp, dropping when raised. There were no evidences of paralysis. No loss of pain sensation. Fibrillary twitchings over the entire body at times, most marked over the left pectoral muscles and the left cheek. All the reflexes were present; the supraorbital was much more marked on the right side.

At two P. M. on the day of admission, the patient was very stuporous and could not be roused in the slightest degree.

Temperature, 99°; pulse, 64; respirations, 18. An immediate operation was deemed advisable, and was performed by Dr, Johnson at 3.30 P. M.

Operation.—An inverted U-shaped incision was made over the posterior part of the right temporal region. The scalp showed some ecchymosis. Four quarter-inch holes were then drilled into the skull, one at each corner of the exposed square. The bone flap was then completed with Hartley's skull saw, and the osteotome and hammer. Immediately on turning back the flap, which was about two and a half inches square, a large, dark blood clot came to view, which was easily removed by the fingers and irrigation. It covered an area half as big as an adult palm, and extended for some distance beyond the bounderies of the bone flap. A sharp spicule of bone along the anterior edge of the flap was removed by the rongeur forceps. The brain was markedly compressed by the clot, and did not pulsate. There was some arterial bleeding from a point in the dura near the lower part of the exposed area (posterior branch of the middle meningeal) which was controlled by a suture of fine catgut, and there was considerable steady oozing from above and in front of the exposed area, the source of which could not be determined, and which continued after temporary packing with gauze. Before the completion of the operation, the depressed brain had expanded and begun to pulsate. As the oozing from above still continued, a plain gauze drain was packed in between the dura and the skull, and led out at the upper, anterior angle of the bone flap, a piece of bone being removed from that corner of the flap by rongeur forceps to make an opening for it. The osteoplastic flap and the muscles were then carefully replaced, and the edges of the scalp united by sutures of silk.

Shortly after the commencement of anæsthesia, the patient's pulse and respirations became very slow, the former falling to 40 per minute, and the respirations to ten. With the opening of the skull, however, the pulse became more frequent, and almost normal; then, for a brief period, the pulse became weak and irregular, but its quality soon improved without stimulation, and the patient left the table in good condition. At 8.30 P. M., on the day of the operation, the patient was conscious. He was able to answer questions intelligently, and said that his

headache was much relieved. The tongue did not deviate. On the following day he was much improved, and the sight of the right eye was apparently good. There was no paralysis, excepting of the face. There was no loss of sensation; reflexes marked. On the third day, when the dressings were changed, the patient said he could hear perfectly well on the right side. His further convalescence was uninterrupted, and he left the hospital, entirely well, on October 15.

BILATERAL ANKYLOSIS OF TEMPORO-MAXILLARY JOINT.

Dr. John A. Hartwell presented a girl of 17, who had an attack of diphtheria when five years old, and at that time it was first noticed that upon attempts to examine her throat, she was unable to open her mouth widely. The parents state that when she was three years old she fell and struck her chin, receiving a cut lip. It was not known that she received any injury to the jaw itself or whether this had any bearing upon the subsequent ankylosis of the jaw.

When the patient came under Dr. Hartwell's observation, last April, there was almost complete immobilization of the lower jaw. When she was asked to open her jaws to the extreme limit, the distance between the upper and lower incisors measured three-eighths of an inch, and she was unable to protrude the lower jaw beyond the upper one. An X-ray picture which was taken failed to show the cause of the obstruction, which was supposed to be due to an ankylosis of the temporo-maxillary joint.

Upon making an incision, Dr. Hartwell said he came down upon a bony mass which was firmly adherent to the zygoma above, and to the outer surface of the ramus below. Its attachment to the ramus was very firm, while to the zygoma it was attached by a band of fibrous tissue. With the chisel and rongeur the attachments were freed, first on one side and then on the other, until the articulation became perfectly normal. The operation was done about two months ago, and the patient was now able to open her jaws to the full extent.

Dr. Hartwell said he could give no cause for the bilateral ankylosis in this case. It was apparently not congenital, and so far as he knew, was unique.

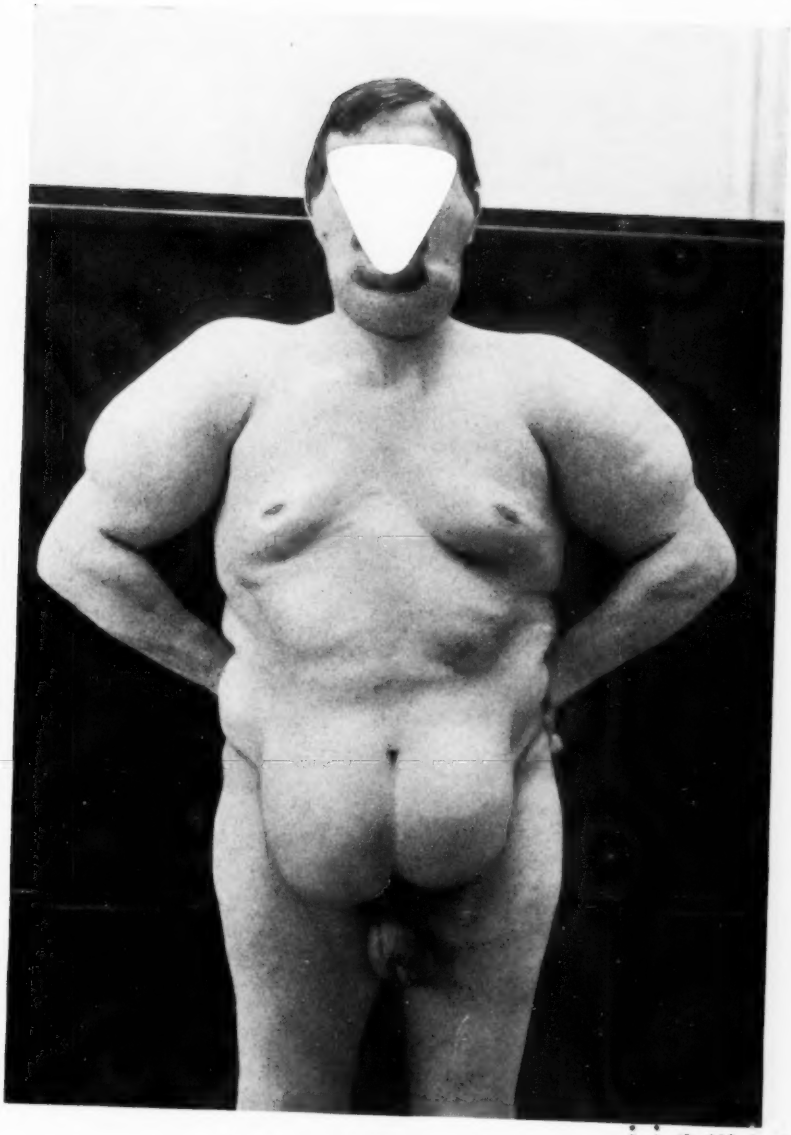

FIG. 1.—Multiple symmetrical lipoma.

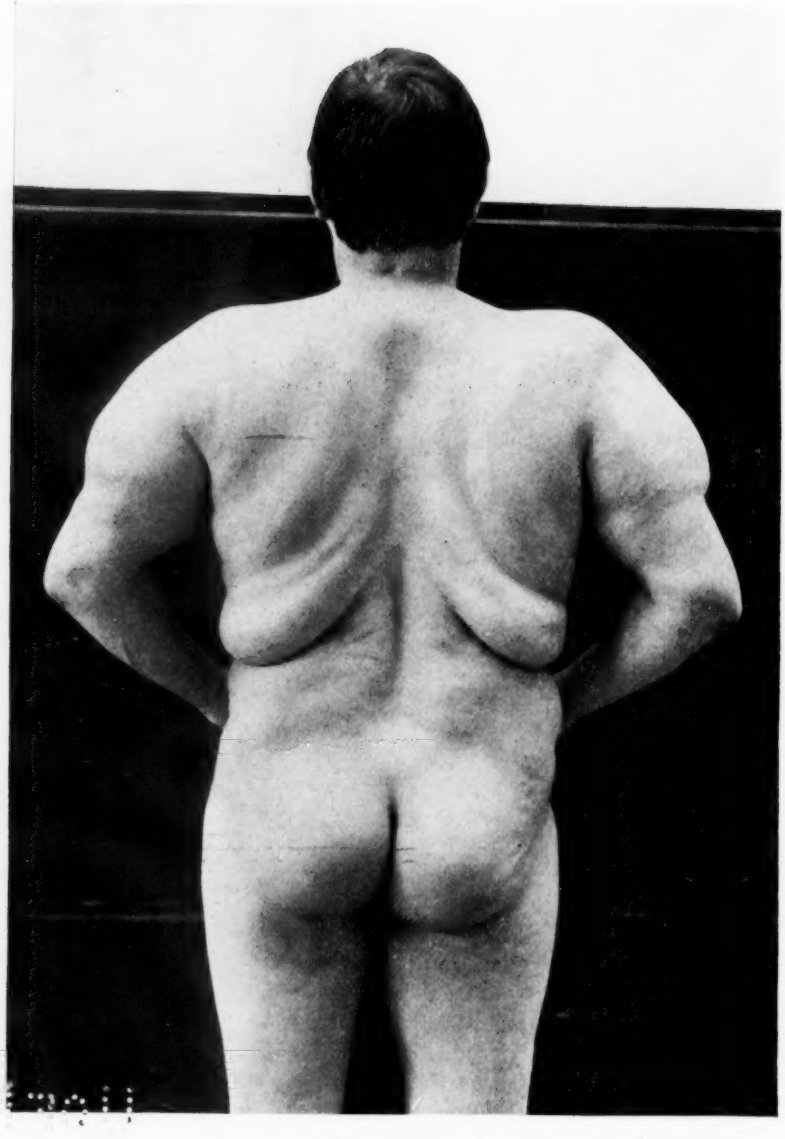

FIG. 2.—Multiple symmetrical lipoma.

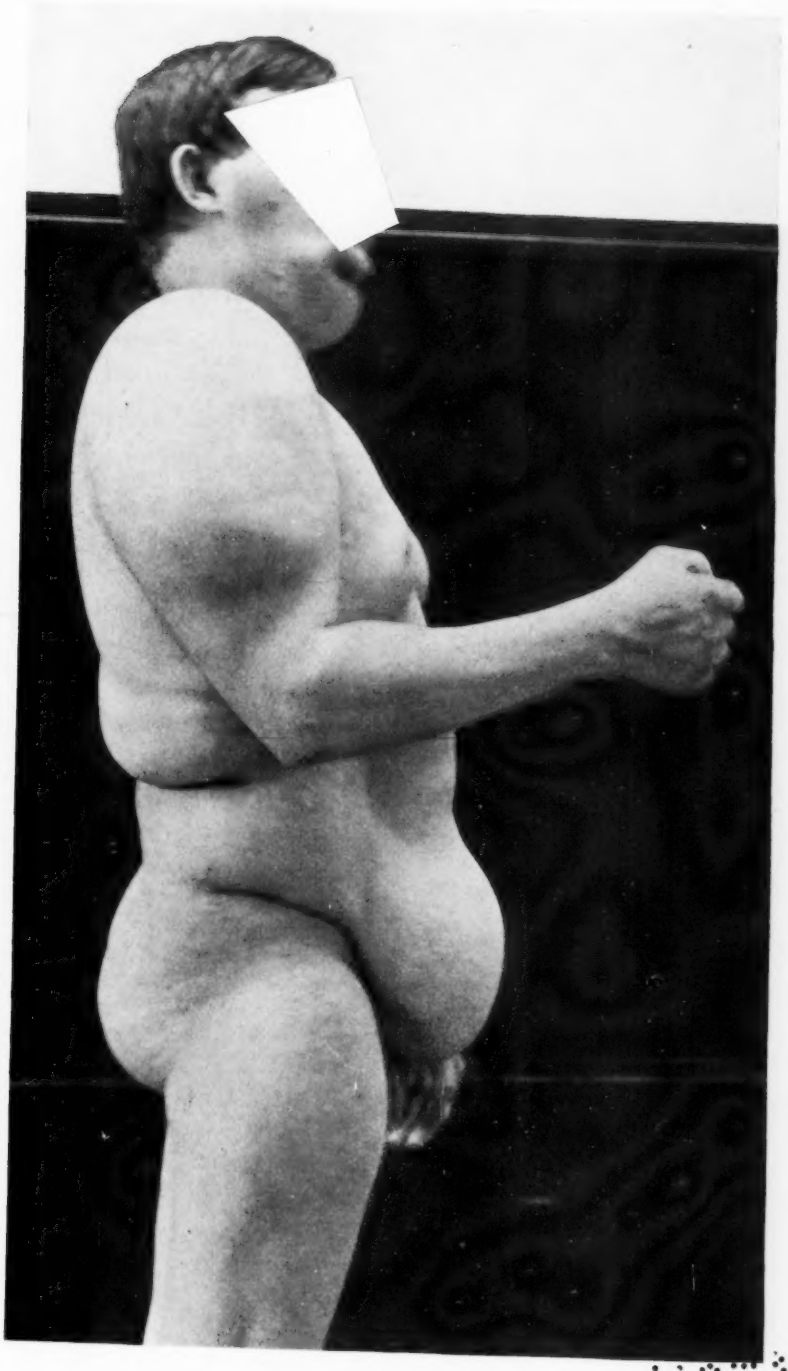

FIG. 3.—Multiple symmetrical lipoma.

TYPHOID, WITH DOUBLE PERFORATION OF THE ILEUM AND PERFORATION OF THE GALL-BLADDER; INTESTINAL SUTURES; CHOLECYSTECTOMY. DEATH TWENTY-ONE DAYS AFTER OPERATION; AUTOPSY.

DR. OTTO G. T. KILIANI read a paper with the above title, for which see page 34.

DR. WOOLSEY said that it was extremely doubtful whether the diagnosis of perforation of the gall-bladder could have been made under the conditions indicated without opening the abdomen. He could recall a number of cases of cholecystitis developing in the course of typhoid fever, but they were all of a comparatively mild character, and the symptoms gradually subsided. In such cases, a recurrence, with stone formation, was not infrequent. Dr. Kiliani's case was certainly both unique and interesting.

DR. KAMMERER mentioned a case in which septic temperature developed after typhoid fever had run its course. A swelling in the region of the gall-bladder finally indicated the seat of trouble and upon opening the abdomen an acutely distended gall-bladder was found. Incision of the same revealed several gall-stones and some seropurulent fluid, from which typhoid bacilli were easily cultivated. The gall-bladder was otherwise normal, and the case healed under drainage and the patient finally recovered after a very long illness.

MULTIPLE SYMMETRICAL LIPOMA.

DR. KILIANI showed a number of photographs of this case. (See Figs. 1, 2 and 3.) The patient was a man, 49 years old. His family history was good. He was markedly alcoholic; denied venereal disease. Four or five years ago he first noticed the appearance of these symmetrical lipomatous swellings, which gradually involved the face, shoulders, abdomen, thighs, etc. Dr. Kiliani said that at the request of the patient he had extirpated two of these swellings in front of the ears, on account of the disfiguration they had given rise to.

DR. KAMMERER referred to two cases of symmetrical lipoma, which he had observed almost ten years ago and in which a marked diminution in the size of the tumors followed the use of thyroid extract.

Dr. Woolsey said he saw a case during the past year in which the lipomatous masses occupied the axillæ and both sides of the neck and were somewhat painful. The growths in this case were in a woman who was operated on for gall-bladder disease.

Dr. Kiliani, in closing the discussion, said the type of cases of which he had shown photographs was entirely different from that in which the tumors apparently followed the course of certain nerves.

Stated Meeting, November 14, 1906.

The President, Dr. George Woolsey in the Chair.

SUBCUTANEOUS RUPTURE OF POPLITEAL ARTERY AND VEIN.

Dr. Benjamin T. Tilton presented a boy 17 years old, who on June 27, 1906, was seated on the rear end of a large truck, with his legs hanging over the end. The truck was on the car-track and started to leave it in order to allow a car that was following to pass by. The motorman of the car did not allow the driver sufficient time to get off the track, and collided with the rear end of the truck, the car striking the boy a blow on the flexed knee, and forcing the back of the knee against the tail-board of the truck. The boy complained of great pain in the popliteal space, and was unable to walk. He was brought to Bellevue Hospital by ambulance.

Upon admission, the physical examination showed a slight abrasion on the front and outer side of the knee below the patella. The knee was held in a slightly flexed position. There was a fulness in the popliteal space. There was no ecchymosis, and the knee-joint contained no blood. There was no tenderness in front, but posteriorly there was marked tenderness in the popliteal space. Extension of the knee was impossible on account of the pain. There were evidences of loss of circulation in the foot and leg.

On the following day the swelling in the popliteal space had increased, extending further up and down the leg. There was a slight yellow discoloration in the calf. Absence of pulsation in the leg and foot persisted. On the following day an

operation was undertaken to relieve the pressure of the increasing hæmatoma which was causing the patient great pain, and to determine the condition of the popliteal vessels.

An Esmarch bandage was applied, and an incision made in the popliteal space. A fair amount of clotted blood was evacuated, and it was found upon inspection that both the artery and vein were completely severed, the two ends of each being separated fully an inch. There were thrombi in the proximal ends. As consent for amputation had not been obtained the artery and vein were ligated proximally and distally, and the wound partially sutured. It was noted that the amount of hæmatoma seemed small in relation to the size of the vessels which had been completely ruptured.

The pain in the leg continued, and signs of beginning gangrene of the moist variety showed themselves. The temperature rose gradually to 105°, and there was evidently no chance of saving any part of the leg, which had now become infected, On account of the threatening sepsis, a Gritti amputation was performed on July 10, thirteen days after the injury. There was not sufficient healthy skin tissue behind to permit of approximation with the anterior flap; consequently, the wound was left open, posteriorly, and packed. No infection occurred, in spite of the close proximity of the amputation to the gangrenous areas. The sawn surface of the patella united promptly with that of the femur.

The granulating surface behind was finally covered by skin grafts a few weeks after the amputation, and a good stump resulted. The case was interesting, Dr. Tilton said, First, on account of the rarity of this particular injury; Secondly, because of the question of the mechanism that produced it; Thirdly, because of the very slight accompanying injury of the skin and soft parts; and, Fourthly, the question of possible suture of the divided artery and vein.

Dr. L. W. Hotchkiss said that he had had one case similar to the one presented by Dr. Tilton. The patient's leg was caught between the buffers of two cars. There was a comminuted fracture of the lower end of the femur, slightly compounded, which was treated in the usual way, as the full extent of the injury was not at first recognized. Rapidly developing gangrene of the foot led to an incision over the popliteal space,

which revealed a complete rupture of the artery, the two ends of the vessel being widely separated. Amputation of the leg was followed by recovery. In this case he thought the question of arterio-venous anastomosis was out of the question.

Dr. Frank W. Murray said that some years ago, at the old Chambers' Street Hospital, he saw a sailor who had met with a similar accident while paying out rope on a tugboat. His leg was caught in a coil of the rope, and he received a very severe wrench in the region of the knee. When he was brought to the hospital there were no signs of a fracture; there was some laceration of the skin, and a slight hæmatoma in the popliteal region, with exquisite pain, and entire absence of pulsation in the anterior and posterior tibials. On the following day the condition being practically unchanged, the popliteal space was explored, and a complete rupture of the popliteal artery and vein was found, and though the ends of the severed artery were curled up, the condition of the ends of the severed vessels, together with the laceration of the surrounding tissues did not allow of any attempt at an end-to-end suture, so amputation at the knee was performed.

Dr. Howard Lilienthal, in reply to a question as to whether a suture of the vessels would have been feasible in a case like the one reported by Dr. Tilton, said he had had no personal experience with injuries of that character. If suture of the vessels was resorted to in such a case, it would have to be done after the manner demonstrated by Carrel, which he would subsequently describe in his paper.

RESECTION OF THE ANKLE FOR TUBERCULOSIS.

Dr. Walton Martin presented a girl, ten years old, who was admitted to the Roosevelt Hospital January 19, 1906, in the service of Dr. Blake.

For the past two years she had been suffering from tuberculosis of the right ankle. The ankle was much swollen; she was unable to walk on account of the pain, and there was a discharging sinus near the inner malleolus. The X-ray showed a focus of diseased bone in the lower end of the tibia, near the epiphyseal cartilage.

Conservative treatment was carried out for three months. The sinus was curetted, the joint immobilized, and the child

was kept for the greater part of the day in the fresh air. During this period, Dr. Norman E. Ditman treated the child with injections of tuberculin. The tuberculo-opsonic index was .5 on February 17; on April 6 the index was 1.5. Notwithstanding, the joint, after a period of temporary improvement, became worse. The pain increased, and the swelling extended to the region of the external malleolus.

On May 4, 1906, the joint was resected. The ends of the tibia and fibula were sawn across, and the astragalus removed. The diseased capsule was dissected out, the old sinus curetted and drainage tubes were introduced in the lateral incisions. The temperature reached normal twenty-one days after the operation. The old sinus and the drainage openings closed gradually, and the child was discharged from the hospital cured early in July. She passed the following two months at Sea Breeze, Coney Island. At present she is in good health, has a movable ankle and can walk without pain or discomfort.

Dr. Hotchkiss said he saw the patient in the Hospital early last summer, and again after her return from Sea Breeze, and had been struck by the remarkable improvement in her condition.

Dr. Joseph A. Blake, who had also seen the patient, said. that for a time her condition was regarded as very precarious. The improvement in her appearance, to which Dr. Hotchkiss had referred, was so marked that one would scarcely recognize her as the same person.

SMALL ROUND-CELLED SARCOMA OF THE NECK AND TONSIL; ENTIRE DISAPPEARANCE IN SEVEN WEEKS UNDER TREATMENT WITH THE MIXED TOXINS OF ERYSIPELAS AND BACILLUS PRODIGIOSUS.

Dr. William B. Coley presented a man, 32 years of age, who had already been shown by him at the January, 1906, meeting of the Society. His family history was good. The patient had been referred to him on October 17, 1905, by Dr. Arpad G. Gerster as an inoperable case of recurrent, small round-celled sarcoma. The following history was obtained.

About the middle of August, 1905, the patient noticed a swelling on the left side of the neck, just behind the sternomastoid muscle. At about the same time he also noticed an

enlargement of his left tonsil; there was no pain at first, but as both tumors increased rapidly in size, they soon became painful. In the latter part of August, 1905, the patient was operated upon at St. Mark's Hospital by Dr. Carl Beck, who made an attempt to remove the tonsil tumor, as well as that of the neck. He found it impossible, however, to make a complete excision. The patient was immediately put upon the X-ray treatment every other day, and also received radium treatment externally and internally; the latter, however, had little if any influence in checking the rapid growth of the tumor. On October 13, while under the care of Dr. Goldwater, at the New York Polyclinic, a portion of the tonsil tumor was removed and examined by Dr. F. M. Jeffries, Director of the Pathological Laboratory of the New York Polyclinic, and also by the Pathologist of the Practitioners' Laboratory, both of whom reported the tumor to be a small round-celled sarcoma.

On October 17, when Dr. Coley first saw the patient, a physical examination showed the following condition: The left side of the neck was occupied by a globular tumor, about the size of half an orange; it extended from the angle of the jaw in front to the mastoid process behind, and downwards nearly to the clavicle. Its consistence was about the same as that ordinarily found in round-celled sarcoma; the skin was not adherent. Examination of the left tonsil showed that it was enlarged to two or three times its normal size. The patient's general health had been but little affected. He was admitted to the General Memorial Hospital on October 17, 1905, and immediately put upon the mixed toxins of erysipelas and prodigiosus, without any other treatment. Daily injections were given, alternating, one day into the tumor direct; the other, into the pectoral region. The highest dose given was seven minims; his temperature ranged between 99.5 and 103. In less than a week there was a decided decrease in the size of the tumor, and an increase in mobility. The diminution continued steadily, until, at the end of six weeks, both the cervical and tonsil tumor had apparently entirely disappeared. He left the hospital at the end of seven weeks, and although there were no visible remains of the tumor, the toxins had been kept up twice a week in the pectoral region as a prophylactic against further recurrence.

Dr. Coley said it was interesting to note in connection

with this case that the toxins, which were prepared by Dr. B. H. Buxton, of the Loomis Laboratory, were eight months old.

Dr. Howard Lilienthal asked Dr. Coley what proportion of cases of sarcoma treated by the mixed toxins were apparently cured. Also, whether he had noted that metastases might occur in spite of the use of the toxins. In this connection, Dr. Lilienthal said, he wished to report the probable final history of a patient whom he had shown on two occasions to the members of the Surgical Society. The patient was a young girl with a sarcoma of the scapula; this was removed, and she made an excellent recovery. There was, however, a slight local recurrence, which disappeared under the use of Coley's fluid. She then remained well for a period of almost two years. Recently she returned with a recurrence in the mastoid of the corresponding side. After that had been operated on by Dr. Charles A. Elsberg, and removed quite radically, there was a further recurrence in the lung, and the patient was now rapidly failing and in an apparently hopeless condition.

Dr. Lilienthal said that while the final result in this case had been extremely disappointing to him, there were enough cases on record in which the mixed toxins had produced a complete and apparently permanent cure to make it well worth while to make use of the remedy.

Dr. Coley, in reply to Dr. Lilienthal, said that speaking approximately, the mixed toxins had produced an apparent cure in from ten to fifteen per cent. of the cases that he had treated personally. When it is remembered that these were all inoperable, hopeless cases, the results are encouraging. The speaker said that formerly he had limited the use of the toxins to inoperable cases, but now he was becoming more strongly in favor of employing the remedy, as Dr. Lilienthal has suggested, as a prophylactic measure. He recalled one case, where, seven years ago, he had removed a small periosteal tumor of the finger, which was regarded as benign. Sections of the growth were submitted to Dr. Welch, of Baltimore, and two pathologists in this city, and all three pronounced it a small round-celled periosteal sarcoma. The advisability of amputating the finger then came up, but as the patient strongly objected to such a radical measure, the toxins were used as a prophylactic. This was seven years ago, and thus far there had been no signs of a recurrence.

Dr. Coley said he could recall about 20 cases in which toxins had been used as a prophylactic measure. A very large number of these patients were still well. He knew of others where they apparently had no effect on the progress of the disease. The only thing to do was to test them. He said he was confident that they did not cause metastases, and the case which he showed at a last meeting of the Society, a sarcoma of the femur, periosteal round-celled, with an enormous metastatic growth on the back and one in the pectoral region disappeared under the use of the toxins. And the patient was well four years proved that the toxin may be successfully used, even with extensive metastases. The action of the toxins is systemic, not local.

SARCOMA OF THE INGUINAL GLANDS, SIMULATING HODGKIN'S DISEASE.

Dr. Coley presented a man, 37 years of age, who was admitted to the General Memorial Hospital on August 24, 1906, having been referred by Dr. A. G. Gerster as a case of inoperable sarcoma. Family history negative. The patient stated that he had always been in good health. Three years ago, he first noticed a small swelling in the right groin. This grew slowly until it reached the size of a walnut; was never painful and general health remained perfect. Five months prior to his admission the lumps in the groin began to increase in number and to grow rapidly in size. They finally interfered with his walking.

Physical examination at the time of his entrance to the hospital showed heart and lungs normal. His right inguinal region is occupied by a number of independent tumors, more or less closely fused and extending deeply into the iliac fossa. The skin over the growths was freely movable. The right thigh and leg were considerably swollen. Inasmuch as the tumor mass seemed so unusually movable, it seemed wise to attempt removal. This was done by Dr. Downes on Sept. 4, 1906. An incision, 9 ins. long, was made from the anterior superior spine, passing over the middle of Poupart's ligament and down along the course of the femoral vessels and a very large number of nodules, varying in size from a marble to a lemon, all more or less completely surrounded by a capsule, were removed. The peritoneum was opened accidentally in one place and closed with catgut sutures. The wound healed

satisfactorily, without suppuration. Microscopical examination of the growth, made by Dr. Clark, assistant pathologist of the hospital, and confirmed by Dr. Wood of the College of Physicians and Surgeons' laboratory pronounced it Hodgkin's disease. Portions of the tumor were also examined at Cornell laboratory and the same diagnosis was made.

Blood examination on May 7 showed: Red cells,4,200,000; white cells, 51,000; polymorphous 35 per cent.; lymphocytes 65 per cent.; hæmoglobin 80 per cent.

After the wound had healed, the nucleo-proteid serum from a case of Hodgkin's disease, prepared by Dr. S. P. Beebe from the Huntington Laboratory Fund for Cancer Research, was begun. Nine tubes of 15 cc. each were given without apparent effect. Oct. 16 the serum was given up and the patient was put upon the mixed toxins of erysipelas and bacillus prodigiosus. Up to the present time 19 injections have been given in doses of ½ mm. to 13 mm. at the present. On October 16 the right thigh measured 18¼ inches, being two inches larger than the left. Physical examination at that time showed the right inguinal and iliac regions occupied by a tumor which apparently infiltrated the adjacent structures, as its limits could not be well defined. In the right hypochondriac region, just to the right of the median line, there was a hard mass evidently attached to the spine and extending from the median line nearly over to the lumbar region and up almost to a level with the right costal arch. No enlargement of the spleen and liver could be detected. During the past month, under the toxin treatment, there has been some improvement in the abdominal condition; the tumor in the iliac fossa is somewhat smaller and the mass in the right hypochondrium is not nearly so pronounced. Measurements of the leg remain the same.

The principal reason for showing this case, he said, is that it emphasizes very clearly the striking similarity between Hodgkin's disease and sarcoma.

This case, together with a number of others, somewhat similar, which had come under his observation, had strengthened the opinion he had long held, that Hodgkin's disease is really a variety of sarcoma, rather than an independent disease.

Dr. George E. Brewer said he had now under treatment a case almost identical with the one shown by Dr. Coley. The

patient had a large glandular tumor in the groin, sections of which had been removed and pronounced Hodgkin's disease. The accessory glands in other parts of the body were also enlarged. In a similar case observed last spring, the serum treatment was very satisfactory.

Dr. Andrew J. McCosh said he was inclined to agree with Dr. Coley that Hodgkin's disease resembled sarcoma far more than it did tuberculosis. He had recently operated for the third time on a middle-aged man who had enlarged glands in the neck and other parts of the body. The first operation was done about four years ago, at which time he removed a large number of glands which the pathologist declared to be lymphosarcoma. Eighteen months ago a second operation was done. A number of glands were again removed, and these were pronounced probably lymphosarcoma. Three weeks ago the third operation was done, and the same pathologist reported that the case was one of Hodgkin's disease, making no mention of lymphosarcoma.

The pathologist's reports in this case, Dr. McCosh said, went to show that either there must be considerable difficulty in distinguishing between the two conditions, or else that the tissues had undergone some change since the date of the previous examinations.

Dr. Blake reported the case of a woman who had a number of enlarged glands in the neck and axillæ. Those in the neck were removed, and the pathologist pronounced the case one of Hodgkin's disease. Subsequently, some of the axillary glands were removed and were reported tubercular. Later on there was an enlargement over the ribs, and the development of a tubercular sinus connected with the thoracic cavity. Dr. Blake said that when he last saw the patient, she was dying, apparently of Hodgkin's disease.

RESECTION OF THE SHOULDER AND ELBOW FOR TUBERCULOSIS.

Dr. Willy Meyer presented a Swedish woman, 32 years old, who had been operated on at Stockholm a number of times for tuberculosis of the right shoulder and right elbow, from which she had suffered since her thirteenth year.

When Dr. Meyer first saw the patient, in October, 1897,

both of the affected joints showed a typical tuberculous inflammation. He first resected the shoulder, (October) and subsequently the elbow, according to the Kocher method (December). The functional result of both operations was excellent. The woman, whose occupation was that of a waitress, had a strong right arm which she could use for all purposes, excepting that she was unable to raise it fully, and that pronation and supination were also slightly impaired. The operations were done nine years ago.

Dr. Meyer said he considered the Kocher method of resection far superior to that of Langenbeck. The former gave an excellent exposure of the parts, and all the important attachments of the tendons were preserved.

END-TO-END ARTERIOVENOUS ANGEIORRAPHY.

Dr. Howard Lilienthal read a paper with the above title, for which see page 1.

Dr. Blake said that from a theoretical standpoint certain objections to the procedure described by Dr. Lilienthal had occurred to him. In the first place, the ligation of the femoral vein was dangerous even when the vessels were normal. Again, it seemed to him that when the femoral artery was attached to the vein, the blood would take the shortest course back by the anastomotic branches with the superficial abdominal veins and through the veins around the hip joint, and not circulate through the terminal veins of the extremity. Another objection would be a production of a pressure stasis throughout the veins of the limb.

Dr. John B. Walker said that during the meeting of the American Medical Association in Boston last June, a case was shown at the Boston City Hospital in which the femoral artery and vein had been divided, the upper end of the femoral artery had been sutured to the lower end of the femoral vein, the lower end of the femoral artery had been sutured to the upper end of the femoral vein. Primary union had occurred. The patient suffered from gangrene of the foot.

Dr. Willy Meyer said the case referred to by Dr. Walker was probably that of Dr. Joshua C. Hubbard, of Boston, which was operated on in April, 1906, and described in the October, 1906, issue of the Annals of Surgery. In Dr. Hubbard's case

the patient, who was eighty years old, recovered from the operation, the femoral artery being cut and anastomosed to the vein and the vein divided and sutured to the artery. The procedure failed to check the gangrene. When the leg was amputated, about six weeks later, both the anterior and posterior tibials spurted arterial blood. The veins did not seem to carry arterial blood. The patient left the hospital in good condition.

Dr. Meyer also thought that such operations should be tested in the human subject in suitable cases, but he fears, that gangrene once having set in, can not be checked in this way.

Dr. John A. Hartwell asked Dr Lilienthal whether Dr. Carrel, in his experimental work, had occluded the femoral artery by multiple ligatures, so as to prevent a return of the circulation through that vessel.

Dr. Lilienthal, in closing the discussion, said he had considered this matter very carefully before he decided to risk the operation in the human subject. In reply to the theoretical objections raised by Dr. Blake, the speaker said that Dr. Carrel had succeeded in producing a complete reversal of the circulation, so that the veins carried arterial blood outwards, and the arteries carried venous blood back again. The blood, in its return course, did not necessarily take the shortest channel back to the heart; at least, that fact had been demonstrated in the normal animal. Whether it was so under pathological conditions, such as he had had to deal with, Dr. Lilienthal said he did not know. In a similar case in the future, if he found the popliteal artery occluded, he did not think he would again venture to operate higher up. Of the conditions he had mentioned in his paper in which the operation was perhaps justifiable, that of angeiosclerotic gangrene was the most hopeless. If there was a mortality attached to the operation, then, of course, it had no place, and amputation was preferable.

In reply to Dr. Hartwell, Dr. Lilienthal said that Carrel's work had been experimental, and limited to normal animals, and he was quite certain that he had not made any experiments that compared in a fair way with the pathological conditions that were encountered in this case.

REVIEWS OF BOOKS.

SURGERY: ITS PRINCIPLES AND PRACTISE. By Various Authors. Edited by WILLIAM WILLIAMS KEEN, M.D., LL.D., Professor of the Principles of Surgery and of Clinical Surgery, Jefferson Medical College, Philadelphia. Vol. I, 8vo., pp. 983. W. B. Saunders Company, Philadelphia, 1906.

This is the first of a series of five volumes in which the editor, Professor Keen, with the help of more than three score collaborators, has proposed to present surgery as it is understood and practised to-day. As one runs over the names of the contributors, from Abbe to Young, if he is at all conversant with the men who are the leaders in the surgical activities and problems of the day, he can but feel that they represent the best which the present generation has produced, and one looks forward with a confident expectation of value and character in the treatise as a whole. The plan of the work and the selection of his collaborators is the fruit of the ripened judgment of the veteran teacher, author and surgeon, whose name the work as a whole must bear. It will remain as a fitting monument to his surgical genius and his practical abilities as a man of affairs. May he be spared long to enjoy the fruit of his labors and the applause and affection of his colleagues.

A very few transatlantic names are found in the list of authors: Bland-Sutton, of London, has prepared the chapter on Tumors. His neighbor, Edmund Owen, that on Diseases of the Mouth and Jaws. Mayo-Robson, on the Surgery of the Stomach, and Moynihan on the Surgery of the Pancreas and Spleen, complete the list of English surgeons that have been drawn upon. From the Continent, Albert Kocher, of Berne, is to deal with the Surgery of the Thyroid Gland, and Gottstein, of Breslau, that of the Esophagus. Lannander, of Upsala, presents Local Anæsthesia and Anæsthetics. This completes the tale. It is evident that the treatise will be so preponderatingly American, that it will always be considered as such.

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of a volume every three months, until the whole work is completed. It is to be hoped that this assurance will be realized in the performance. It will be truly characteristic of cisatlantic energy and push, if it is done The reviewer in a moment of weakness twenty-seven years ago enrolled himself as a subscriber to the series of volumes to compose the Deutsche Chirurgie, "Herausgegeben von Billroth und Luecke." The series is not completed yet! The volumes continue to come to hand from the German publisher at irregular intervals. The title pages now bear the inscription, "Begründet von Billroth und Lecke." Other names have succeeded to the responsibilities of the "Herausgegeben!" Each volume, however, as it has appeared has been complete and encyclopædic up to the date of its publication, and possesses a permanent value as a book of reference, if not as a guide to present practice. It is the latter element, however, which most appeals to the average American practitioner of medicine. He wants something for his present use and immediate practical guidance. In a previous generation Gross was the great teacher who personally dominated as a teacher of surgery, both in the amphitheater and as an author. There was a vigor, a directness, a personality to his great work, the two volumes of his system of surgery, that never failed to engage the interest and confidence of the reader. No subsequent writer has been able to "bend his bow," unless it be Fowler in those volumes which he left behind him as a record of his energy and his enthusiasm.

The last forty years have produced a series of most important and valuable surgical treatises by American authors and from American presses that have in succession well presented the conditions of surgical knowledge and practice of their respective dates: The International Encyclopædia, edited by Ashhurst; the system edited by Dennis and Billings; the scholarly volumes of Agnew; the condensed epitomes of Ashhurst, of Roberts, of Wyeth, of Da Costa and of Brewer; the great American text-book edited by Keen and White; the volumes of Park and of Warren, of Wharton and Curtis and of Fowler, together constitute a body of surgical teaching and practice of the highest interest and the greatest credit to the profession of this country. In the rapid development of the surgery of the present, the life of a surgical text-book is necessarily very brief. That publishers, shrewd men of business and

well acquainted with the field from which patronage is to be obtained, should at such short intervals be putting out from their presses such expensive publications as those already mentioned, of the recent past, to be succeeded now by such an one as this "Surgery" edited by Keen, or that which is now disputing with it the favor of the profession, the series edited by Bryant, speaks well for the intelligence and enterprise of the medical men of the country who are to be the buyers of these expensive books, and to whom it is simply requisite that a book should be the best and the latest to secure its purchase whatever its cost.

The introductory chapter in this first volume of Keen's Surgery is by James G. Mumford, of Boston, and is entitled "Narrative of Surgery: A Historical Sketch." It is good reading. The style is animated and the descriptions are most interesting. Hippocrates and Galen receive due mention, and then a skip is made over fifteen hundred years to Vesalius. We could wish that this able pen could have said something about the Schools of Salernum, of Bologna, of Montpellier; of such surgeons as Mondeville, de Chauliac, Argelata, Berengarius da Carpi, and that he might have gone a little more into detail as regards the work which the Arabians did, all in this interval between Galen and Vesalius. The hiatus is too great. Our modern surgeons need to be informed as to the development and traditions of their art, and who so well fitted to do it as the accomplished and learned author of this chapter?

The remaining chapters of this volume are devoted, as would be expected, to topics pertaining to the Principles of Surgery and to General Surgery. A good index closes the volume. The merits of the book are such as will make one anxious for the appearance of its successors.

LEWIS S. PILCHER.

A TEXT-BOOK OF GENITO-URINARY DISEASES. By DR. LEOPOLD CASPER, Professor in the University of Berlin. Translated and edited with additions, by DR. CHARLES W. BONNEY, of Philadelphia. P. Blakiston's Son & Co., Philadelphia, 1906.

Doctor Leopold Casper, the author of this treatise, is a recognized authority on the subject of genito-urinary diseases. He is without question an enthusiast on the subject, as all those who

have studied under him will acknowledge. He is an indefatigable worker and a logical and scientific thinker. In his clinic in Berlin one sees all classes of genito-urinary diseases. As a teacher he has the art of imparting to his students a clear insight into the subject which he presents.

In his book this same enthusiasm and clearness is very evident. He divides his book into a General and a Special Section. In the General Section are considered the Examination of the Patient, Anatomy and Physiology of the Genito-Urinary Tract, Physical Methods of Examination, and Physical, Chemical and Microscopical Examination of the Secretions. This may seem to be but a repetition of what many other authors have already presented, but when one studies this section carefully he is impressed with the originality and value of the treatise as coming from the pen of a man who has actually done the work, and has excluded many of the worthless and time-consuming methods which other authors still cling to.

The Special Section treats of the various Diseases of the Genito-Urinary Tract and of the Functional Disturbances of the Sexual Organs.

The discussion of radical operations for hypertrophy of the prostate has been written conjointly by the author and Charles W. Bonney, the latter having translated the German edition, and edited the present American edition.

The book is eminently practical, and will rank high among the text-books on Genito-Urinary Diseases.

SURGICAL ASPECTS OF DIGESTIVE DISORDERS. By JAMES G. MUMFORD, M.D., Surgeon to the Massachusetts General Hospital, etc., and ARTHUR K. STONE, M.D., Physician to Out Patients, Massachusetts General Hospital, etc. 8vo., pp. 395. The Macmillan Company, 1905.

The era that dawned with the operative treatment of appendicitis, and whose light brightened with the recognition of gall-bladder disease as a surgical affection, has lightened more and more as Moynihan, Robson, the Mayos and others have published their successes in the operative relief of other chronic abdominal conditions, especially those affecting the stomach and intestines. As one turns the pages of the work now under consideration the

conviction grows that the field of the internalist is rapidly being narrowed and that the day of pills and potions is passing.

If one were to find nothing more in Professor Mumford's pages than his review of medical history it would sufficiently demonstrate how recent is any real knowledge of diseases of the stomach, and how rapidly such knowledge has placed a large proportion of gastric complaints in the list of mechanical disorders that demand for their relief not medicine but the knife. One feels as he reads an enthusiasm that urges him to recommend all his patients to have their abdominal organs repaired and rearranged, and it is not until some time has elapsed that sober afterthought raises a question as to whether we are yet sufficiently experienced to see such surgical treatment in its true perspective.

This much seems certain: A number of chronic gastric diseases, including chronic ulcer, dilatation with stagnation, gastric tetany, and some others, are markedly benefited by gastro-enterostomy. The pain subsides, the nervous symptoms disappear, and the patient regains his health and strength.

The authors discuss these questions at some length and present a number of statistics from various sources bearing on both sides, for and against operation. They instance the frequency with which cancer of the stomach is overlooked, dwell on the deplorable inadequacy of late operation for its relief, discuss the symptoms and diagnosis somewhat fully, and conclude that exploratory laparotomy should be more frequently undertaken.

Interesting chapters are devoted to the bile passages and the pancreas. Glénard's disease with the other abdominal ptoses receives intelligent discussion, and the appendix comes in for an extended consideration, especially chronic appendicitis and the results of operation. A number of interesting records are cited showing how previously unsuspected chronic appendicitis with only mild inflammation and adhesions seemed responsible for a variety of digestive disturbances, and how operation gave relief.

Dr. Henry F. Hewes furnishes an interesting and valuable—because complete and concise—appendix dealing with the diagnosis and significance of gastrectasis, of gastric ulcer and cancer, and containing the records of a number of gastric cases with clinical and postmortem finding.

It is to be regretted that a book so full of excellence should

be somewhat marred by the style in which it is written. The sentences are often involved and there is a frequent abrupt change of subject that demands so close attention on the reader's part as to cause him to occasionally lose the meaning. The importance of the subject and the judicious way in which it is presented, however, more than counterbalance this literary defect and are recommendation enough without reviewer's comment.

HENRY GOODWIN WEBSTER.

ATLAS AND TEXT-BOOK OF HUMAN ANATOMY. Volume I. By PROFESSOR J. SOBOTTA, of Wurzburg. Edited, with additions, by J. PLAYFAIR MCMURRICH, A.M., Ph.D., Professor of Anatomy at the University of Michigan, Ann Arbor. Quarto, 258 pages. Philadelphia and London: W. B. SAUNDERS COMPANY, 1906.

Prof. Sobotta's aim in preparing this atlas has been to provide a work which should be practical and not too comprehensive, furnishing illustrations true to nature, and especially adapted to the use of medical students in the dissecting room. It is not an atlas for the finished anatomist, and can not be classed with the more extensive work of Toldt.

In the original German edition, the text and atlas were separate volumes, and in preparing the English edition Prof. McMurrich has united the text and atlas in a common volume. The nomenclature employed is essentially that proposed by the Basel Committee on Anatomical Nomenclature, most of the terms being anglicized. It is entirely different from most text-books of anatomy, in that it is a descriptive atlas.

Volume I treats of the Bones, Ligaments, Joints and Muscles. As might be expected in such a work, the illustrations are the most striking features; multicolor lithography has been extensively employed, and almost the entire myology has been illustrated in this manner. The other illustrations are mostly half-tones, and all of them are accurate and most excellently executed.

It is to be regretted that in the section on Osteology, the illustrations do not indicate the points of attachment of the muscles to the bones. This is always a most puzzling question for the student to solve, and should be considered in compiling such a work. The descriptions, however, of the bones are

clear and comprehensive. The sections on Joints and Muscles are beyond criticism. The work, as a descriptive atlas, leaves nothing to be desired.

PAUL PILCHER.

DISEASES OF THE DIGESTIVE SYSTEM. Edited by FRANK BILLINGS, M.D., 8vo., pp. 824. D. Appleton & Company, New York, 1906.

"Die Deutsche Klinik," edited by Julius L. Salinger, M.D., is being made available for English readers in the series of volumes on Modern Clinical Medicine, now three in number, of which the present volume is one. The list of contributors is perhaps the best critique of its merits: Ewald, Boas, Hoppe-Seyler, Nothnagel, Leo, Strauss, Neusser, Rosenheim, Riegel, Hirschfeld, Oser, Minkowski, Stadelmann, Kraus, Fleiner, Vierordt, Strasburger. One can add nothing to the authority with which these men speak.

The chapters of this work are each complete separate articles contributed by the clinicians mentioned, independent but correlated by the general subject of digestive diseases.

If one were to choose from among so many noteworthy contributions, possibly the one by Oser, of Vienna, on the Symptomatology of the Diseases of the Pancreas would first arrest attention, if only on account of the obscurity from which pancreatic diseases and their determination are just emerging. Associated as it is with the liver, deeply hidden in the abdomen and so difficult of digital appreciation, it has been long neglected, even in necropsies; while its rapid self-digestion post mortem has helped to obscure its pathology.

Recent work on the normal and abnormal constitution of the fæces and on the physiology of proteid and hydrocarbon digestion has directed attention to the functions of the pancreas and seems to offer certain points of diagnostic value in the estimation of pancreatic activity. Collective reports on the pathology of the organ have demonstrated its relation to some forms of diabetes, so that the analysis of the urine offers some help. The conclusions drawn in Oser's article are these: Pancreatic disease may be reasonably assumed when examination of the fæces shows a disturbance in the digestion of albumin as

evidenced by undigested meat, and insufficient fat digestion, other causes being discounted. The details of the article cannot be considered here.

An exceedingly interesting contribution is that by Riegel on the diagnosis and treatment of gastric dilatation, as is one by Ewald on gastric ulcer and gastric hæmorrhage. The latter modestly points to a personal experience of over 1250 cases. The etiology he declares to be not yet satisfactorily explained, except where direct trauma can be proven. A valuable table comparing the symptoms of nervous gastralgia, ulcer and cancer is included. Under Treatment he advocates in general the method by large doses of bismuth in suspension, appropriate diet and laxative alkaline drinks—as Carlsbad water. Surgical intervention is advocated only after persistent medical efforts have failed, and in selected cases.

The section on the examination of the fæces, by Strasburger, is remarkable for its excellent illustrations—many in color—of normal and abnormal fæcal constituents. Its brevity is compensated for by its lucid presentation.

Fleiner presents an excellent contribution on diarrhœa, intestinal catarrh and intestinal tuberculosis; Boas one on constipation and hæmorrhoids, and Vierordt one on acute diffuse peritonitis, appendicitis and perityphilitis. Space prevents enumeration and discussion of the other articles, all of which are notable.

The work will prove a valuable addition to every working library.

HENRY GOODWIN WEBSTER.